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ENVIRONMENTAL HEALTH PRACTICE IN RECREATIONAL AREAS. A GUIDE TO THE PLANNING, DESIGN, OPERATION, AND MAINTENANCE OF RECREATIONAL AREAS

National Center for Urban and Industrial Health
Cincinnati, Ohio

1968

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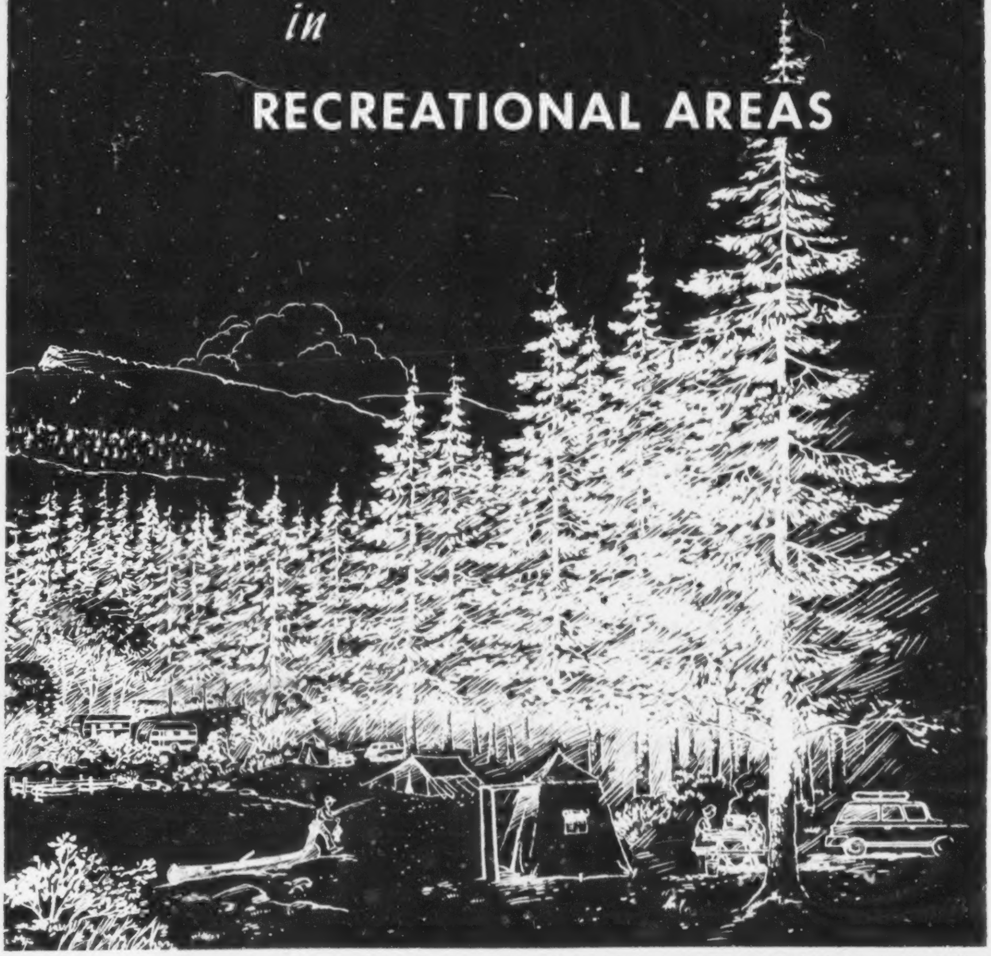
Environmental Health Practice in RECREATIONAL AREAS



U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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Quotes

"Planning for public recreation must be as systematic as planning for schools, roads, and municipal water. This objective can be met by giving full recognition to outdoor recreation in local comprehensive land-use plans. Through long-term planning, schedules of priorities and of investment requirements can be prepared.

In order to be effective, planning must have active community support. The public must be convinced of the need for both taking full advantage of existing public areas and facilities and acquiring new ones."

—From *Outdoor Recreation for America*, a report by the Outdoor
Recreation Resources Review Commission

Public Health Service Publication No. 1195

Environmental Health Practice in RECREATIONAL AREAS

A GUIDE TO THE PLANNING, DESIGN, OPERATION, AND MAINTENANCE OF RECREATIONAL AREAS

Details of illustrations in this
document may be better studied
on microfiche.

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
NATIONAL CENTER FOR URBAN AND INDUSTRIAL HEALTH
Environmental Sanitation Program
Cincinnati 45202

I

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II

Preface

Environmental Health Practice in Recreational Areas is designed to provide guidance to persons responsible for planning, designing, operating, and maintaining recreational areas. The standards presented and the practices recommended have proven successful for many years in Federal, State, and local parks and other recreational places in minimizing or eliminating health and safety hazards.

Those having a special interest in detailed design criteria of utilities or sanitation facilities may refer for further guidance to publications listed under "References" or contact State and local health departments for specific applications.

Jerome H. Svore, *Director*
National Center for Urban and Industrial Health

Introduction

The conservation, development, and wise use of outdoor recreational resources are of great importance in satisfying the social and health goals of our population. Expanding leisure time, growing interest in outdoor recreation, increased mobility of people, and a rising standard of living make it possible for more people to seek and utilize recreation areas.

The term "recreation area" refers to land and water areas dedicated to the enjoyment of the public. These developments generally involve facilities operated by a public agency, concessionaire, or voluntary or private groups or individuals and include parks, campgrounds, shelters, picnic areas, travel trailer parking areas, resorts, motels, hotels, cabin camps, organizational camps, marinas and other facilities relating to a variety of activities—swimming, fishing, hunting, boating, sailing, hiking, picnicking, camping, touring, and sightseeing.

Attention to the environmental health aspects of recreational problems has been stimulated greatly by the increasing demand for outdoor recreation as indicated in the Outdoor Recreation for America Report[1] and illustrated in figure 1.

In many instances the planning, provision, and maintenance of facilities in recreational areas have not kept pace with this rapidly increasing visitor load. As a result optimum use of such areas is not possible and deterioration of overtaxed facilities is frequently encountered. Where facilities such as water supply, sewage disposal, and refuse handling are inadequate or totally lacking, the visitors will fend for themselves, often creating conditions which are grossly insanitary as well as creating serious environmental health hazards for themselves and neighboring community residents. Available recreation facilities in 1960, even though currently considered inadequate by many authorities, will need to be tripled by the year 2000. Estimates are that adequate environmental health safeguards comprise approximately 30 percent of development costs of new recreation areas, therefore investment in adequate and efficient facilities is justified from the economic standpoint.

Experience has demonstrated that whenever a large number of persons are concentrated in one place, health problems are accentuated. The increasing number of visitors to recreational areas creates a need for planning and constructing adequate health-related facilities as well

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as to educate the public to observe good sanitary and personal hygiene practices. The need for continuing research and studies to develop improved standards and solutions to environmental health problems peculiar to recreation areas and activities should be recognized.

In recognition of the stated relationships between recreation and public health interests and in order to obtain maximum health protection of the population from environmental health hazards in outdoor recreation areas, it is urged that all Federal, State, and local public or private agencies, groups, or individuals having responsibility for the planning, development, design, operation, or maintenance of recreation areas apply high standards of public health and sanitation in the administration of and supervision of their programs. A high level of performance in this regard can be facilitated by maintaining close cooperation and consultation with health and sanitation authorities and realized by following applicable environmental health standards and criteria as authorized in this guide of the responsible Federal, State, or local jurisdiction that may be involved.

"In a fruitful new partnership with the states and cities the next decade should be a conservation milestone. We must make a massive effort to establish—as a green legacy for tomorrow—more large and small parks, more seashores and open spaces than have been created during any period in our history."

—*President Lyndon B. Johnson*

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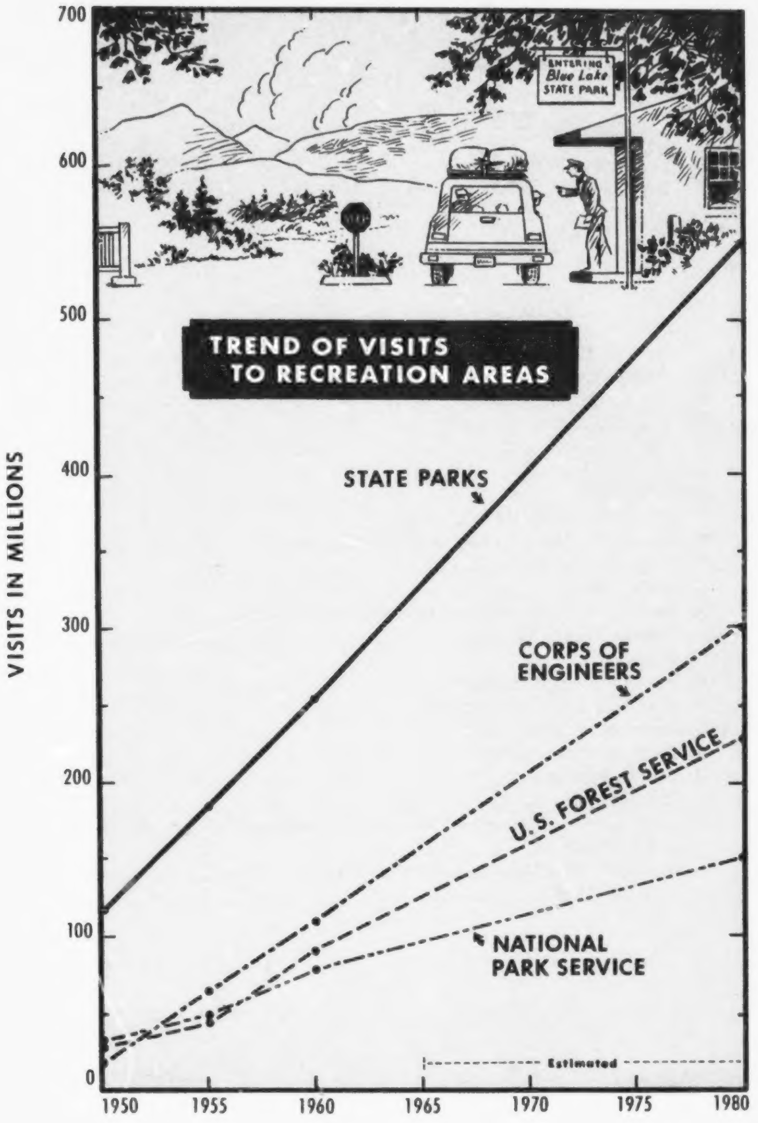


ENTERING
Blue Lake
STATE PARK
STOP
TREND OF VISITS TO RECREATION AREAS
VISITS IN MILLIONS
700
600
500
400
300
200
100
0
STATE PARKS
CORPS OF ENGINEERS
U.S. FOREST SERVICE
NATIONAL PARK SERVICE
Estimated
1950
1955
1960
1965
1970
1975
1980

Figure 1.

Chapter I

Public Health Aspects

There are many important considerations which must be included in the overall planning, development, and operation of recreation areas to insure that proper health protection of individuals visiting or residing in such areas will be provided and maintained. Among the requisites for a safe and healthful environment in such areas are the following:

(1) Drainage, soil permeability, ground water, location and possible effects of swamps, streams, lakes on health and safety.

(2) Development of sources, treatment, and distribution of water supply to meet quality and quantity standards for domestic and culinary use.

(3) Proper collection, treatment, and disposal of sewage wastes to prevent pollution hazards that may cause disease or produce other undesirable effects.

(4) Proper storage, collection and disposal of garbage and other refuse.

(5) Design of kitchen, dining, and other facilities to insure that safe handling and serving of food and drink to the public can be accomplished. Certification of sources of foods, frozen desserts, and milk and milk products during operation.

(6) Adequate and safe housing, including campsites, cabins, dormitories, and other public use buildings.

(7) Control of insects and rodents.

(8) Elimination of accident hazards and promotion of safety.

(9) Design and operation of outdoor bathing areas and swimming pools.

The most effective means to insure consideration of these public health aspects and assessment of their present and future significance is by active cooperation between health and recreation agencies. The development and review of plans of proposed developments and facilities by qualified public health engineers is recommended. A program should be established to conduct periodic sanitary surveys in recreation areas and inspection of facilities and their operation.

PLANNING

Planning for recreation includes the process of gathering and analyzing pertinent facts and data as a prerequisite to sound decisionmaking, formulating goals, developing plans, and acting to carry out those plans. The objective of planning is to minimize or eliminate future problems through the application of informed judgment and foresight, thereby helping to insure a pleasant, healthful, and safe environment which includes an adequate quantity and variety of suitably developed recreation areas.

Preplanning conferences with representatives of all agencies interested in proposed recreational developments are desirable inasmuch as this procedure assists planners in providing projects which will serve the greatest number of people without impairing the areas for the enjoyment of future generations.

It is seldom possible to fulfill all desirable site criteria for the location of recreation areas and of their intensively developed portions. However, any location being considered within a recreation area for development of such a facility as a motel, campground, picnic area, travel trailer parking area, cabin camp, organization camp, resort, bathing area, headquarters, management buildings, visitors center, and other development should be well drained, gently sloping, free from topographical or geological hindrances, and accessible to proposed sources of water supply or sewage works. Sites should be free from heavy traffic and noise sources. To be most acceptable and efficient, sites should not encroach on the natural, scenic, esthetic, scientific, or historic values of the recreation area. Avoiding locations near swamps and marshes, where insects such as mosquitoes may breed and cause severe annoyance and discomfort, will enable full enjoyment and utilization of the area by the visiting public.

The review of plans and specifications for proposed sanitary facilities in recreation areas is often the most important single procedure available to improve health and sanitation conditions in recreation areas. It has long been recognized by public health authorities that it is more possible to manage and operate sanitary facilities such as water supply systems, sewage works, incinerators, and food service establishments in a satisfactory manner if sanitary defects and hazards are "built-out" during the planning and design stage. For this reason, public health authorities stress the use of design criteria or standards which serve (1) as a guide in the design and preparation of plans and specifications which meet public health requirements, and (2) to establish uniform design practices within the agency having design and construction responsibilities. Conformance to high standards is essential to provide the type of sanitary facilities that rule out health hazards to users of such facilities during their expected long period of uninterrupted service in recreation areas.

To carry out the intent of these requirements, plans and specifications for sanitary facilities in recreation areas should be submitted to a reviewing authority for review and recommendations. Appropriate changes should be incorporated in the plans and specifications before contracts are let or construction is started. This activity can only be accomplished by developing procedures for coordination between the health and other agencies having responsibility for recreation planning, design, and construction.

Problems Peculiar to Recreation Areas

There are unusual conditions of location and use encountered in many recreation areas which often make it difficult to apply solutions or procedures found satisfactory in the average city or community to provide adequate public health protection. These conditions may include—

(1) *Seasonal Operation.* The operation of recreation areas, such as camp or lake resorts, on a seasonal basis creates many economic problems. Adequate public health precautions require use of devices and equipment such as chlorinators, dishwashing machines, and sewage treatment facilities which are often expensive and raise a question about the economic feasibility in seasonal operations. It is sometimes difficult to justify the cost of expensive equipment if it will be used only 3 or 4 months of the year. Seasonal operation also creates many problems related to personnel and staffing. Experienced personnel to operate modern-type water and sewage treatment facilities or work in food service establishments are often difficult to hire for short operating seasons. Consequently most personnel must be trained and by the time this is accomplished it is time to close the area for the winter.

(2) *Public Behavior.* A serious difficulty in public use of many recreation areas is irresponsibility of some visitors. Complaints are common about vandalism, theft, and thoughtless actions injurious to property and to the general recreation environment. Comfort stations and plumbing fixtures, for example, are special targets of vandalism. Picking up trash and litter left by visitors, and repairing petty damage is often a major expense. Careless disposal of garbage is a major contributing factor to fly production and nuisance in recreation areas. The solution of this problem of public behavior may require major expenditures for additional enforcement or caretaking personnel and an extensive public education program.

(3) *Vector and Animal Problems.* Recreation in the outdoors provides the recreationist with much more exposure to animals, reptiles, and insects which in many instances may pose a threat to health and safety. Infection by rabid bats, ticks causing Rocky Mountain spotted fever, encephalitis, and fleas from rodents infected with plague is possible in many areas. Insects crawling into the ears of outdoorsmen sometimes create painful conditions

that require surgical procedures for removal. Visitors are sometime bitten or attacked by large animals as bears or snakes. Mosquito bites may cause such discomfort to visitors in some recreation areas that the areas are unused or full enjoyment is not possible.

Animals also cause other indirect health problems such as those caused by the activities of bears and wild animals with the contents of refuse containers. Bears are often observed foraging for food in refuse containers, which results in the containers being turned over and refuse scattered about. This increases collection costs and the litter which is not promptly picked up contributes to fly breeding.

(4) *Noxious Plants and Weeds.* Contact with these are increasing as greater numbers of people are exposed to the outdoor environment. Millions of Americans suffer from hay fever and other allergic reactions, such as poison ivy and poison oak. Fortunately, weed control measures may be instituted to provide relief in areas of serious infestation.

(5) *Remote Locations.* Lack of electric power and roads in remote areas causes many design and operation problems. If electric power is unavailable, head for a water distribution system must be provided by other means. Intakes may be located high enough upstream to produce sufficient pressure by gravity flow or internal combustion engines may be used for pumping. Transportation of construction materials and operational supplies to a remote water intake or treatment location may be difficult.

(6) *Landscape and Wildlife Protection.* The objectives of many recreational activities require, among other things, the preservation and the development of the natural scene for enjoyment of present and future generations. This entails considerable effort on the part of planners to assure that the natural scene will not be despoiled by manmade structures such as elevated steel water tanks, water and sewage treatment facilities, and refuse disposal facilities located within view of visitors. This factor of landscape protection requires many sanitary engineering innovations and oftentimes results in the use of alternative methods which are more costly.

Sanitary Surveys

Whether they cover existing facilities, or proposed sites scheduled for development, the importance of field sanitary surveys cannot be overemphasized.

In general, surveys of existing sanitary facilities should be made once each year, although they may be made less often where facilities are limited or more often when health problems indicate a need for more frequent checking. Surveys of sites scheduled for development should be conducted during the early planning stages.

The sanitary survey of existing facilities should be made by a representative of the health authority competent in environmental health and should include the inspection and evaluation of all sanitary utilities and facilities relating to water supply, sewage disposal, refuse disposal, milk and food establishments, plumbing, housing, camps, insect and rodent infestation, travel trailer parking areas, swimming pools and bathing places, and other existing or potential public health problems.

Surveys of existing sanitary facilities should be made in company with local individuals responsible for the operation and maintenance of the facilities. Problems relating to potential health hazards should be discussed and procedures for dealing with particularly urgent health hazards arising from defects encountred should be agreed upon before leaving the area.

Survey reports, including a statement of all health hazards detected, and an assessment of present and future significance together with appropriate recommendations, should be sent to those authorities responsible for the administration and operation of the area. Provisions in accord with such recommendations for proposed developments should be incorporated in the project during the planning stages. Correction of defects covering existing and proposed projects will provide substantial overall public health benefits and prevent or minimize potential public health problems.

Communicable Disease Control

A communicable disease is an illness due to a specific infectious agent or its toxic products, arising through the transmission of that agent or its products from a reservoir to a susceptible host, either directly, as from an infected person or animal, or indirectly through the agency of an intermediate plant or animal host, a vector, or inanimate environment.[2]

People visiting recreation areas come from different environments in many sections of the country and may bring with them unknowingly or harbor diseases that are transmittible to fellow visitors.

Experience has demonstrated that whenever large numbers of people gather in close association with one another, there is increased danger of the spread of any infection from one to another. Recreational visitors often participate in activities and encounter environments in which they are not accustomed, thus resistance to infection from certain communicable diseases may be lessened.

The control of communicable diseases is greatly enhanced if each recreation area is equipped with the good sanitary utilities and facilities discussed throughout this Guide. These facilities should be designed, operated, and maintained in accordance with the requirements of the health agency having jurisdiction.

The control of communicable diseases is a fundamental responsibility of government which is an assigned function of the official health agency having jurisdiction. The health agency in protecting the people under its jurisdiction has certain duties relating to communicable disease control including reporting, isolation and quarantine, hospitalization, immunization, and case investigation. The cooperation and assistance of all other governmental agencies in communicable disease control is constantly necessary in any community.

In some of the more isolated recreational areas where hospital facilities and medical services are not readily available, it should be apparent that there is the need for careful and continuing appraisal of all factors relating to communicable disease control to avoid undesirable outbreaks of disease or infection.

Procedure for Reporting Communicable Disease

The superintendent or administrator of a recreational area should establish the following procedures when communicable diseases in man or diseases in animals transmissible to man are encountered:

1. Whenever an outbreak or suspected outbreak of a communicable disease occurs, the health officer having jurisdiction in the area or region should be notified immediately. Isolation, if necessary, should be maintained in a manner approved or required by the health officer. The cases should not be allowed to leave or be removed from the area without the permission of the health officer having jurisdiction.
2. Unusual epizootics or "die offs" in the wild rodent or animal population should also be reported to the health authorities, inasmuch as some diseases in rodents and animals are transmissible to man.
3. When a physician is assigned to a recreation area, he should be required to report outbreaks or suspected outbreaks to the health authority. This report should contain a recommendation as to whether, in his opinion, an epidemiological investigation should be initiated by the health authority for the purpose of establishing control measures.

Chapter II

Site Selection

Sites selected for recreation areas should be well drained, gently sloping, free from topographical or geological hindrances, and accessible to proposed sources of water supply or sewage works. Sites should be free from heavy traffic and noise sources. To be most acceptable and efficient, sites should not encroach on the natural, scenic, esthetic, scientific, or historic values of the recreation area. Avoiding locations near swamps and marshes, where insects such as mosquitoes may breed and cause severe annoyance and discomfort, will enable full enjoyment and utilization of the area by the visiting public.

LOCATION

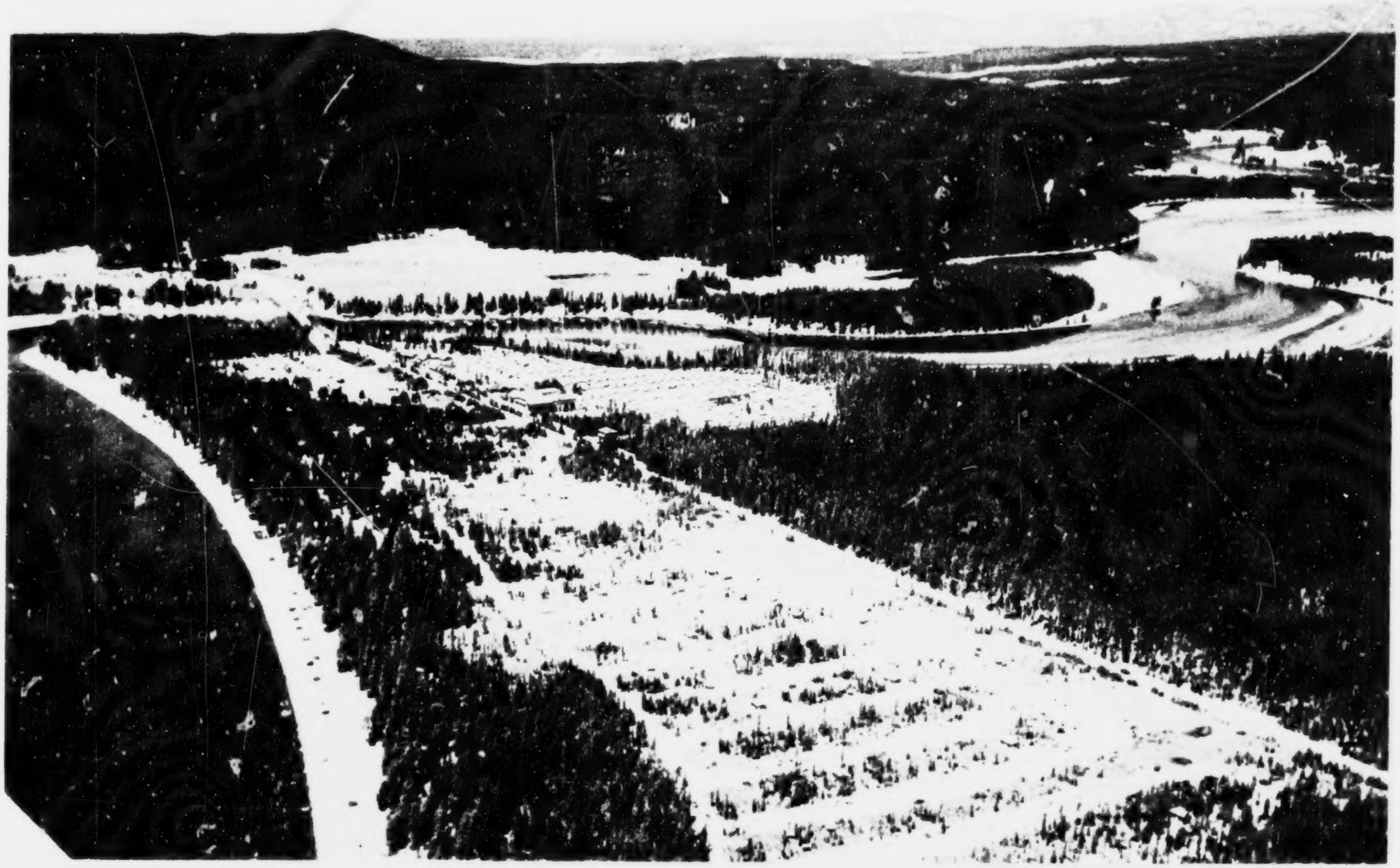
Recreation facilities should be far enough away from main thoroughfares to minimize accident hazards. Roads providing access to the area should be constructed with turns, loops, and other functional layouts so that the excessive speed of vehicles is self-limiting. One-way traffic, if feasible, should be used as one means of minimizing accidents. The roadways should be surfaced to permit travel during rainy weather.

Proposed sites should also be remote from railroads, airports, truck routes, factories, and other sources of noise which detract from a restful and peaceful environment; and as remote as possible from sources of air pollution such as manufacturing plants, refineries, oil-burning power, or industrial establishments that contribute to air pollution, and other sources of smoke, dust, fumes, or objectionable odors.

Proposed developments should be located a safe distance from potential breeding areas for insects and rodents in order to minimize the necessity of using insecticides and rodenticides for their control. Swampy areas and marshes should be avoided, and developed areas should be located beyond the flight range of mosquitoes from these potential breeding areas. An entomological survey should be undertaken to determine the species of mosquitoes or other nuisance insects.

CHARACTERISTICS

Preferably, recereation areas should be located on gently rolling, well-drained land which is free from large rock outcroppings and not subject to flooding. From the drainage standpoint, a desirable site is one on which there is limited or no standing water following heavy rainfall.



Sites on which good natural drainage is not possible may be made suitable by installing drainage systems for the rapid removal of storm water. On steep slopes suitable measures should be taken to prevent erosion.

Fairly previous soil located above the highest recorded water table or level is essential to assist in maintaining a dry area, and to permit the disposal of liquid wastes by means of subsurface disposal. Location with respect to high water levels of adjoining bodies of water should be determined to be certain that sites are not subject to flooding.

Camps to be occupied during the summer months should have an eastern exposure, if possible, so that visitors will receive the benefit of early morning sun and afternoon shade. Camps located on the western shore of lakes or streams will have the desired eastern exposure, and will generally be protected on the west by woods or shade trees.

Lightly wooded sites provide either natural or manmade shade as well as sunshine, and permit rapid dryoff after heavy rains. Trees offer valuable protection from winds, but growth that is too dense will restrict the movement of air, thus interfering with the comfort of visitors during hot weather.

If the proposed site has heavy underbrush, weeds, and tall grass, the brush and weeds should be removed, and provisions made for controlling the grass along paths, trails, roadways, and other developed places to reduce the potential infestation from ticks and other harmful insects.

UTILITIES

In proposed recreation areas where public water supply and sewerage systems are not accessible, authorities should determine, during the early planning stages, whether an adequate supply of potable water can be developed in the area, and whether the site is suitable for the installation of a sewerage system and sewage disposal plant.

A sewerage system which will carry liquid wastes by gravity is desirable, since the power required to pump the wastes increases operation and maintenance costs.

Those responsible for the development of proposed areas should consult an engineer, preferably a sanitary engineer, on problems involving water supply and sewage disposal facilities. State or local health departments should always be consulted regarding applicable laws or regulations relating to these facilities.

Figure 2.—Recreation accommodations site, Yellowstone National Park.

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Chapter III

Watershed Management[3]

Watershed management involves the supervision, regulation, maintenance, and wise use of the aggregate resources of a drainage basin to provide the maximum yield of water of desirable quality, including the control of erosion, pollution, and floods.

The condition of the soil and the growth it supports have a marked influence on the quality and quantity of water contributed by a watershed. The use of various control measures and management practices in watersheds is essential to conserve water resources and to prevent economic losses to municipal, industrial, and agricultural water supplies, fisheries and recreation. In carrying out the various functional activities on watershed lands, including grazing of livestock and game, logging, roadbuilding, fire control, sewage disposal, and recreaction, it is essential that satisfactory watershed conditions be preserved.

The upper reaches of many watersheds in the Nation are still in good condition and yield water of excellent quality. In the lower reaches of some watersheds, however, conditions have been so modified by natural and manmade activities that they now yield contaminated, highly mineralized or turbid water. Since many of the streams and lakes in the upper reaches of watersheds in recreation areas have not been adversely affected, the objective should be to preserve these waters in the best possible condition consistent with reasonable and beneficial future development and use.

Continued population growth and economic progress will necessitate extending resource developments into the upper reaches of many watersheds and utilizing the resources in presently undeveloped areas more extensively. In the utilization and development of land and water resources, Federal, State, and local agencies and private enterprises should consider it their responsibility to—

1. Preserve the excellent quality of water in presently undeveloped areas; and
2. Help restore the quality of water in other areas to conditions to permit increased beneficial use.

The principal activities which affect the quality of surface waters in and adjacent to recreation areas include: construction, logging, grazing of livestock and wild game, mining, public use of developed and undeveloped areas, disposal of wastes, and fire control.

CONSTRUCTION

Construction activities that generally affect the quality of water are: roads, railroads, power transmission lines, mines, and dams. The polluting substances which are likely to enter streams during and after construction include silt, chemicals, oil, gasoline, litter thrown from vehicles, and wastes from construction camps and trains. The control of soil erosion during and after construction is essential to reduce construction and maintenance costs and to maintain water quality. Highway cuts and fills should be stabilized and provided with adequate drainage to prevent erosion. The protection of cuts and fills with natural growth enhances the appearance of these areas and eliminates soil erosion which would otherwise reach adjoining bodies of water as silt after heavy rainfall and thus increase the turbidity of watercourses. Erosion control during and following construction involves good planning of facilities, proper supervision during construction, and adequate maintenance following construction.

LOGGING

Logging operations, when not properly carried out, can contribute to the deterioration of water quality. The utmost care should be taken in planning logging operations, and in locating and constructing logging roads. Deterioration of water quality will be encountered in headwater areas as logging activities move into higher forested areas. Where logging is permitted, controlled cutting of timber is essential to maintain scenic values in and adjacent to recreation areas and to prevent water pollution. The principal polluting substances which are likely to enter a watercourse from timber harvesting and management activities are: silt, logs, brush, decayed vegetation, pesticides, cinders, oil, gasoline, and logging camp wastes. Silt is frequently washed into streams from poorly located or constructed roads, skid trails, burned-over areas, and other attendant operations. Most of the polluting substances that originate during logging operations can be controlled by proper planning and supervision of logging and cleanup operations.

GRAZING

Overgrazing of recreation areas by livestock and game depletes vegetation, thus causing erosion which has an adverse effect on water quality. Where grazing is permitted it should be controlled or restricted so that natural ground-covering plants and grass can be maintained to prevent erosion. Wildlife can be maintained at desirable levels by having a flexible seasonal hunting program. The extent of pollution of water supply sources from animal wastes and dead animal carcasses is a factor in determining the degree of treatment required to assure a safe drinking water supply.

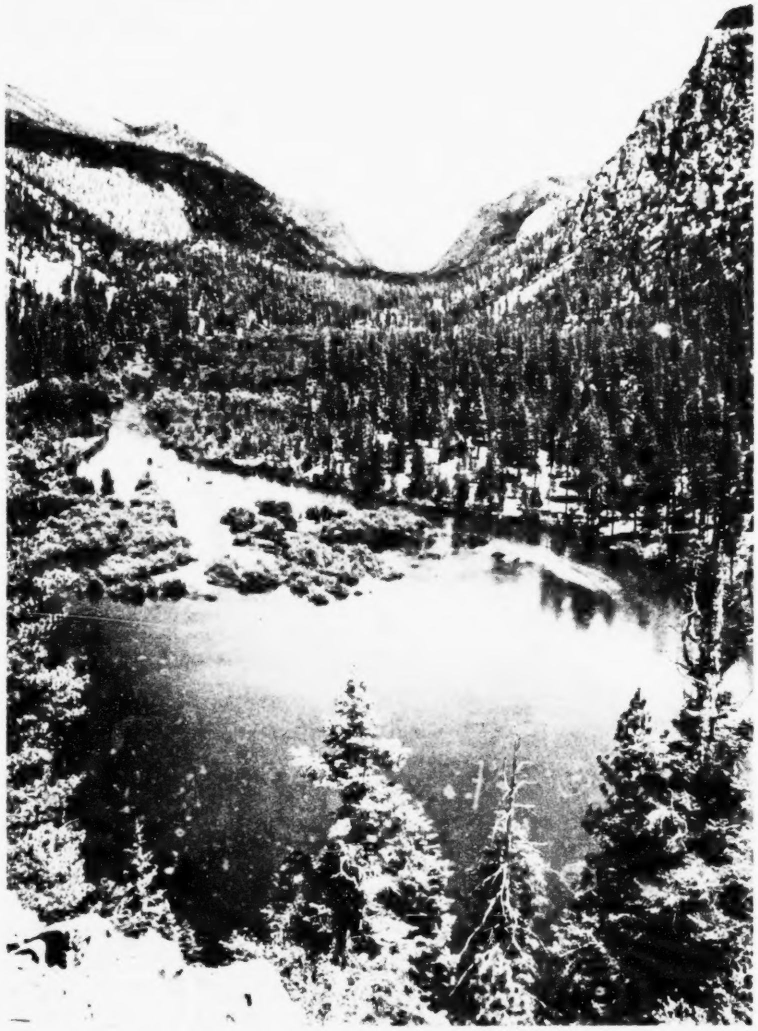


Figure 3.—Big Kern Lake and north upriver.

WASTE DISPOSAL

Proper disposal of domestic and industrial liquid and solid wastes from permanent developments and construction camps in and adjacent to recreational areas is essential to prevent water pollution. All domestic and industrial wastes from these areas should be adequately treated prior to disposal by approved subsurface disposal or by discharge of treated effluents to adjoining watercourses. Garbage and other solid wastes should be disposed of by means of approved methods, including sanitary landfill, incineration, or garbage grinding with discharge to sewerage systems. Sanitary landfills should be located properly in relation to watercourses so that the byproducts or leaching of these wastes will not be responsible for surface or ground water pollution.

MINING AND PROCESSING ORE

Uncontrolled mining and processing of ores may be detrimental to water resources rendering a stream unfit for most water uses. Mines, including spoil banks, which have been worked and abandoned may also cause damage to water resources. The principal activities that affect water quality are: construction and maintenance of roads, strip mining, underground mining, improper stockpiling of wastes, and ore processing. The objectionable substances which have been encountered in streams from these operations are: silt, coloring matter, minerals, acids, and chemicals. Therefore, proper control of mining and ore-processing operations to prevent water pollution is essential. Drainage from abandoned mines and dumps can be controlled by proper sealing and by locating dumps where the drainage from these areas can be kept from entering adjoining watercourses. Abandoned strip mines should be leveled and covered with a layer of the original or new topsoil to permit seeding with an approved vegetative cover.

PESTICIDE CONTROL

A variety of synthetic pesticides are being used in enormous quantities in this country to control undesirable insects, animals, or plants. They may be applied in numerous ways, including the use of aircraft, from which fallout may contaminate water supply reservoirs located miles away from the area being treated.

There is no standard procedure to evaluate the hazard to a water supply reservoir from the use or proposed use of any pesticide on the surrounding watershed. The properties of a given pesticide and the plans for its use which are the prime concern in evaluating a potential health hazard are:

1. *Toxicity.* How much can be tolerated by a human being for how long.

2. *Persistence.* How long will the agent, in its basic formula, be found on or coming from the area to which it has been applied. For example, the chemical half life of stable chlorinated hydrocarbons is measured in years.

Others hydrolize to harmless components in a matter of hours.

3. *Exposure.* What amount of the agent will be applied over what acres and at what dosage per acre. From this information and knowledge of runoff and percolation, some approximation may be made of the amounts, if any, which might be expected to appear in a water supply.

Those considering the possible use of pesticides on their watersheds that are used for water supply should seek the advice of the appropriate Federal, State, or local health authority.

RECREATIONAL AREAS

In developed forested areas, the soil cover may be destroyed by excessive visitor use and overcrowding of recreational and camping sites, thus causing erosion of the topsoil and resulting in physical deterioration of adjoining watercourses. As most outdoor recreation is seasonal, there is usually a period of rest which may assist in the recovery of vegetation and soil cover. However, if a season's rest is insufficient for the revival of plant growth, a moratorium on use of the area, providing artificial cover as paved campsites or the construction of new areas to relieve overcrowding, will be necessary for these areas to recover.

FIRE PREVENTION AND CONTROL

Adequate fire prevention and control measures are of major importance, since fire is a constant threat to the timber and water resources of a forested watershed. Fires caused by lightning and man expose large land areas which are then subject to erosion. Surface drainage from these areas may carry increased color, ash, and turbidity for several years after burning, thus causing widespread deterioration of water quality in the drainage basin. Adequate fire control is essential in all forested areas to minimize damage to watersheds by fires. Uncontrolled camping in forested areas is often the cause of forest fires by careless campers. This problem can be controlled by providing sufficient campgrounds and picnic areas for the public where activities can be supervised. Uncontrolled camping in areas without proper facilities should be prohibited.

CONSERVATION

Most Federal, State, and local agencies that have an interest in the development and operation of recreation areas participate in water conservation practices.

The Soil Conservation Act of 1935 authorizes Federal agencies to execute a soil and moisture conservation program on public lands. The development of water resources under this program is designed primarily to reduce erosion, sedimentation, and flood damage. The use of surface water is further directed toward increasing the productivity of the land through water retention, water spreading, and other land treatment practices. These water developments also serve other multiple purposes through betterment of watersheds.

The very nature of the objectives of Federal and State agencies with a major interest in the development and operation of recreational areas is conducive to good watershed management practices. Practically all of the vast acreage of land managed by the National Park Service, Forest Service, Bureau of Land Management, and Corps of Engineers has improved watershed value. The headwaters of many large drainage basins are wholly or in part in these areas.

Both Forest Service areas and public lands under jurisdiction of the Bureau of Land Management are managed in accordance with the principles of multiple use in order to derive the maximum values for the public. Recreation resources of these areas are made available to the extent consistent with the overall management of the areas. Good water resources management is practiced by these agencies in connection with the utilization of the resources in these areas.

The lands included in the National Park Service areas embrace the headwaters of some streams and large segments of various river watersheds. The National Park Service policy is to provide for the enjoyment of these areas so as to conserve the scenery, the natural historical objects, the wildlife therein, and to leave them practically unimpaired for the enjoyment of future generations. This policy is consistent with good water resource management.

With increased use of our watersheds and continued demand for opening of additional watersheds for recreational purposes, it has been generally necessary to restrict development in some cases in order to maintain water quality, especially when the watershed serves as a source for public water supplies. When proposed plans for recreational development involve the watersheds of water supply reservoirs or lakes, the appropriate State or local health authorities should be contacted regarding requirements covering their use.

While the determination of the effects of recreation use on watersheds is usually always dependent on a study of local conditions and factors, a useful guide on this subject can be found in a *Statement of Policy on Use of Water Storage Reservoirs for Public Recreation* adopted by the American Water Works Association.[4]

Chapter IV

Water Supply

An adequate supply of water under pressure which meets the bacteriological, chemical, physical, and radiological requirements of the Public Health Service Drinking Water Standards [5] or equivalent is essential for the convenience, comfort, safety, and health of visitors and resident staffs at outdoor recreation areas.

According to the Drinking Water Standards, a "water supply system includes the works and auxiliaries for collection, treatment, storage, and distribution of the water from the source of supply to the free flowing outlet of the ultimate consumer."

When feasible, water should be obtained from an approved public water supply system to obtain the advantages of qualified supervision which provides added assurance that the quality and quantity of water will be adequate at all times for domestic and firefighting purposes. Where public water supply systems are not available within a reasonable distance for extension to recreational areas, the best available and least contaminated source should be developed and protected for this purpose.

Proposed sources of water supply require a sanitary survey of the source and the results of bacteriological and chemical examinations of the raw water to provide essential information regarding the type and degree of treatment needed.

CLASSIFICATION OF WATER SUPPLY SOURCES [6]

The vast majority of water supplies available to recreational areas generally fall in the following classifications:

Group 1. *Water Requiring No Treatment.* This group is limited to underground waters obtained from wells, springs, and infiltration galleries not subject to any apparent possibility of contamination and meeting in all respects the requirements of the Drinking Water Standards as shown by satisfactory, regular, and frequent sanitary surveys and laboratory examinations.

If available, ground water supply of desirable quality and quantity generally provides the most satisfactory sources of supply for small recreational areas, because such supplies require minimum treatment, operation, and maintenance to assume a constant safe water supply.

Group 2. *Water Requiring Disinfection Only.* This group includes both underground and surface waters subject to a low degree of contamination and meeting the requirements of the Drinking Water

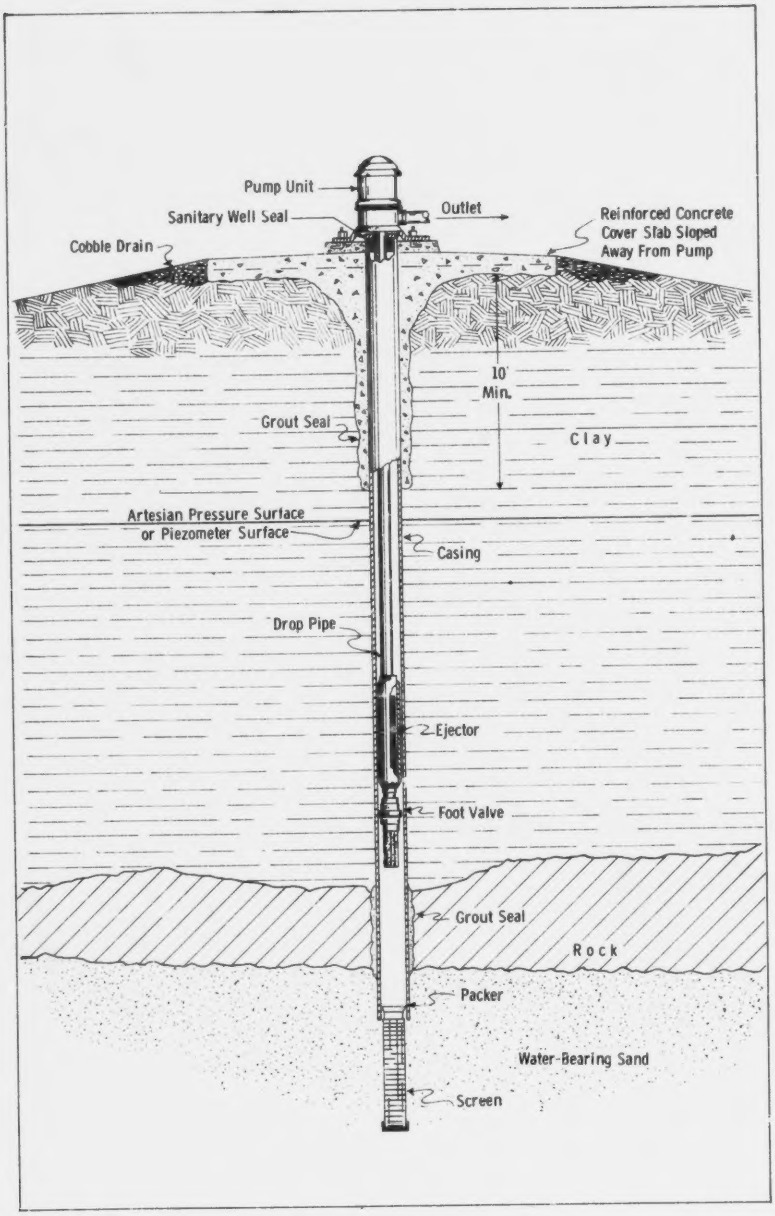

Pump Unit
Outlet
Sanitary Well Seal
Reinforced Concrete Cover Slab Sloped Away From Pump
Cobble Drain
10' Min.
Grout Seal
Clay
Artesian Pressure Surface or Piezometer Surface
Casing
Drop Pipe
Ejector
Foot Valve
Grout Seal
Rock
Packer
Water-Bearing Sand
Screen

Figure 4.—Drilled well.

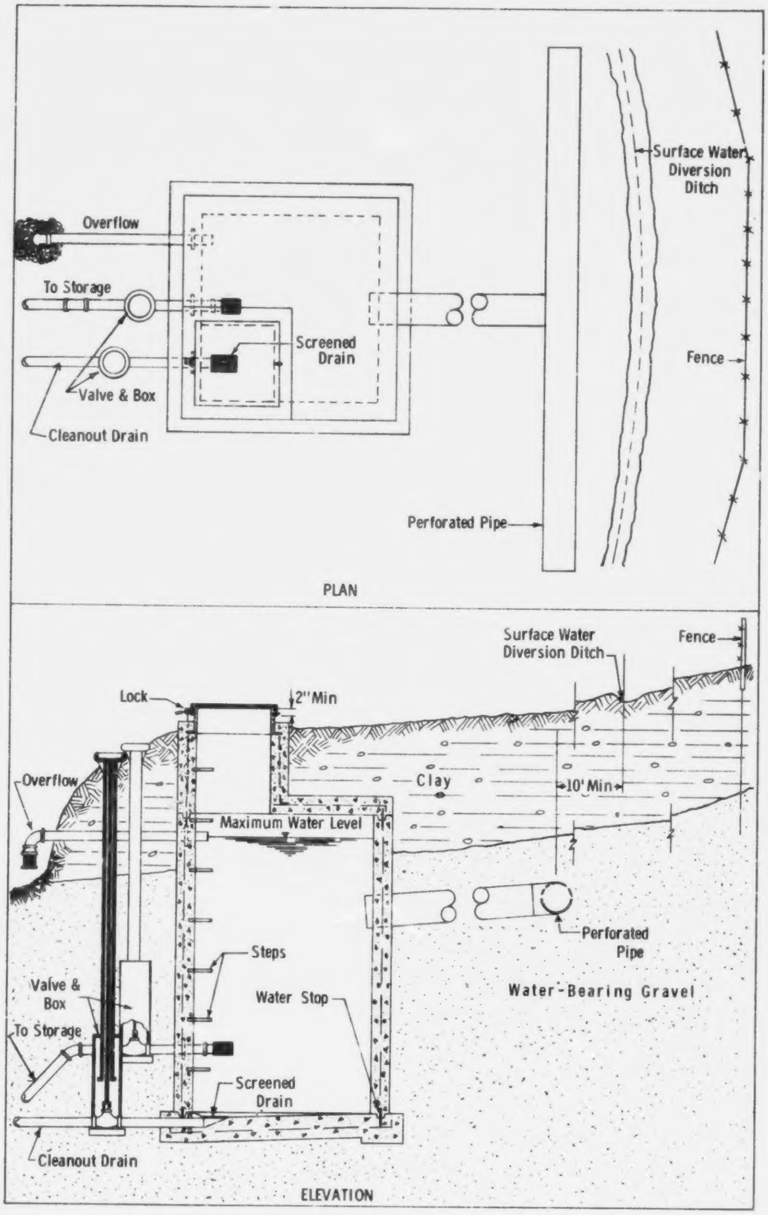

Overflow
To Storage
Screened Drain
Valve & Box
Cleanout Drain
Surface Water Diversion Ditch
Fence
Perforated Pipe
PLAN
Surface Water Diversion Ditch
Fence
Lock
2"Min
Overflow
Clay
10'Min
Maximum Water Level
Perforated Pipe
Steps
Valve & Box
Water Stop
Water-Bearing Gravel
To Storage
Screened Drain
Cleanout Drain
ELEVATION

Figure 5.—Spring protection.

Standards in all other respects except as to coliform bacterial content, which should not average more than 50 per 100 ml. in any month.

All *surface water* supplies regardless of source are subject to chance undesirable contamination and, therefore, require some form of treatment. The extent or degree of treatment is governed by the chemical and physical characteristics of the raw water and the extent of contamination or pollution that reaches the source.

Group 3. *Water Requiring Complete Treatment.* This group includes all waters requiring coagulation, sedimentation, filtration, and chlorination treatment pre and post for color and turbidity removal; waters of high or variable chlorine demand; and waters polluted to such an extent as to be inadmissible to groups 1 and 2, but containing numbers of coliform bacteria averaging not more than 5,000 per 100 ml. in 20 percent of the samples examined in any one month.

Group 4. *Auxiliary Water Supplies.* At recreational areas without developed sources of supply, water from approved sources may be hauled to the development in tank trucks and dispensed directly from the tanks or from reserviors which are filled for this purpose. Although the source of water may be safe for drinking purposes, the following precautions should be taken with the tanks used for hauling to eliminate chance contamination during handling:

(*a*) The tank interior should be devoid of sanitary defects, and should be thoroughly cleaned and disinfected prior to being placed in service.

(*b*) Tank lining materials should be nontoxic.

(*c*) The tank should not be used for other purposes.

(*d*) As an added precaution, chlorine solution should be added to the water in the tank to provide a chlorine residual of at least 0.2 ppm of free chlorine after the chlorine has been in contact with the water for at least 20 minutes.

(*e*) One hose should be used for filling and unloading the tank and stored on the truck in a covered container when not in use. It should be thoroughly flushed with clean water before each use.

QUANTITY OF WATER

One of the first steps in the selection of a suitable water supply source is determining the demand which will be placed on it. The essential elements of water demand include the average daily water consumption and the peak rate of demand. The average daily water consumption must be estimated—

1. To determine the ability of the water source to meet continuing demands over critical periods when surface flows are low and ground-water tables are at minimum elevations; and
2. For purposes of estimating quantities of stored water which would sustain demands during these critical periods.

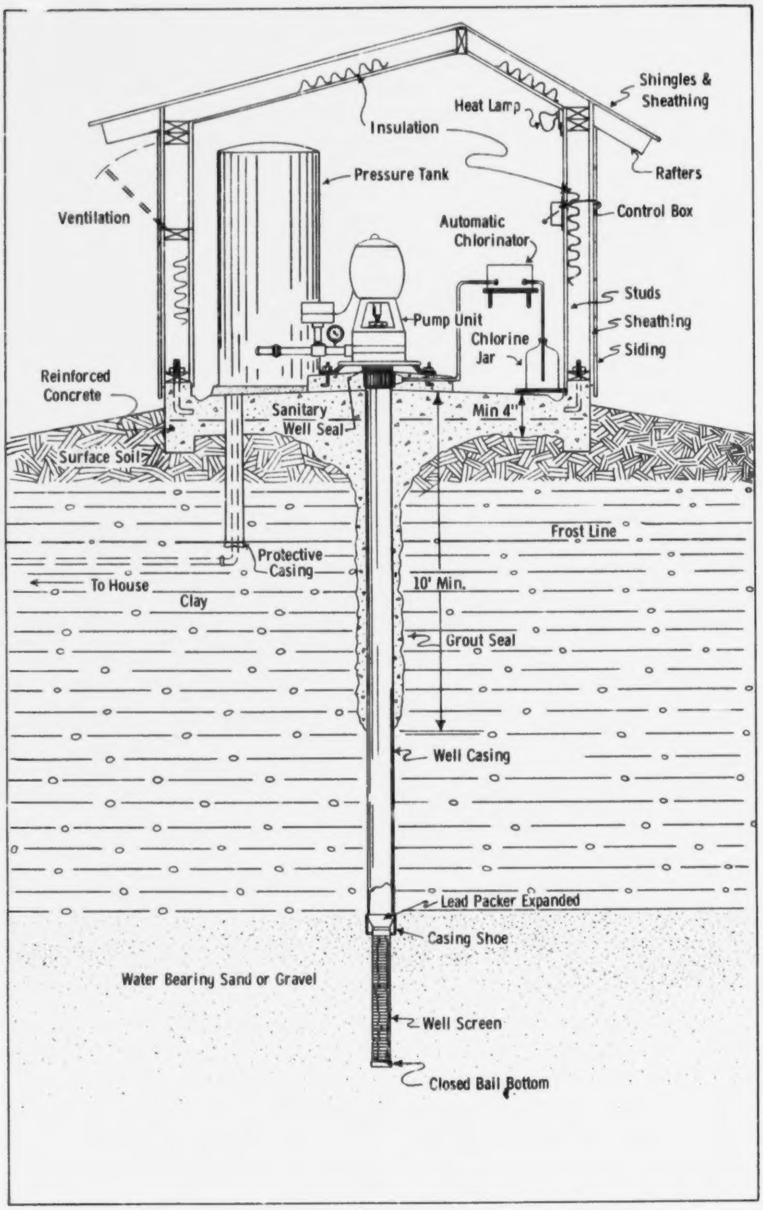

Shingles &
Sheathing
Heat Lamp
Insulation
Rafters
Pressure Tank
Ventilation
Control Box
Automatic
Chlorinator
Studs
Sheathing
Pump Unit
Chlorine
Jar
Siding
Reinforced
Concrete
Sanitary
Well Seal
Min 4"
Surface Soil
Frost Line
Protective
Casing
To House
Clay
10' Min.
Grout Seal
Well Casing
Lead Packer Expanded
Casing Shoe
Water Bearing Sand or Gravel
Well Screen
Closed Bail Bottom

Figure 6.—Pumphouse.

The peak demand rates must be estimated in order to determine plumbing and pipe sizing, pressure losses, and storage requirements necessary to supply sufficient water during period of peak water demand.

AVERAGE DAILY WATER USE

Many factors influence water use for a given system. For example, the mere fact that water under pressure is available stimulates its use, often excessive, for watering lawns and gardens, for washing automobiles, for operating air-conditioning equipment, and for performing many other utility activities in recreation areas. Modern kitchen and laundry appliances, such as food waste disposers and automatic dishwashers, contribute to a higher total water use and tend to increase peak demands. Since water requirements will influence all features of an individual development or improvement, they must figure prominently in plan preparation. Table 1, page 29, presents a summary of average water use as a guide in preparing estimates, with local adaptations where necessary.

SAMPLING FOR CHEMICAL, PHYSICAL, AND BACTERIOLOGICAL QUALITY

New Supplies

Prior to the development of a water supply system, a sample of the raw water should be taken from the source to determine the chemical, physical, and bacteriological quality of the water. Samples should be taken and submitted for examination and interpretation in accordance with instructions from a State or local health department or other State-approved laboratory.

The results of the laboratory examination and the findings of a sanitary survey of the source should determine the type and degree of treatment that will be required. In the use of a well supply, a sample should be collected when a pumping test is being conducted to determine its yield and drawdown.

If the chemical and physical quality of the supply meets the Drinking Water Standards, the supply should be fully developed and then disinfected to remove all traces of contamination that may have been introduced during development. Water samples should then be collected for bacteriological examination and interpretation by the health authorities. The supply should not be used for domestic purposes until the report covering the bacteriological examination results shows that the supply is safe for use. If the results are unsatisfactory and continued sampling indicates that additional treatment will be needed to provide a safe supply, the necessary treatment should be provided before the supply is placed in service.

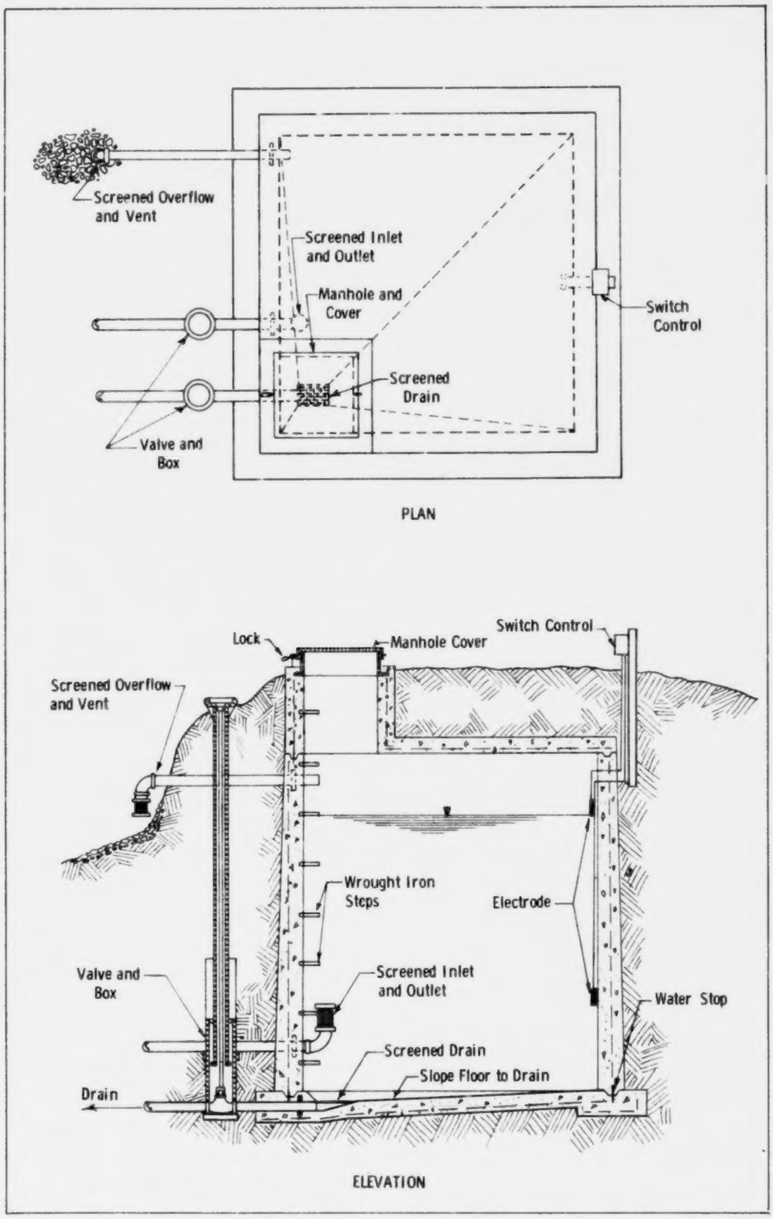

Screened Overflow and Vent
Screened Inlet and Outlet
Manhole and Cover
Switch Control
Screened Drain
Valve and Box
PLAN
Lock
Manhole Cover
Switch Control
Screened Overflow and Vent
Wrought Iron Steps
Electrode
Valve and Box
Screened Inlet and Outlet
Water Stop
Screened Drain
Slope Floor to Drain
Drain
ELEVATION

Figure 7.—Typical concrete reservoir.

Existing Supplies

When the source of supply has been adequately treated and otherwise protected against contamination, compliance with the bacteriological requirements of the Drinking Water Standards should be based on the examination of samples collected at representative points throughout the distribution system. When bacteriologically unsatisfactory samples are obtained, immediate and active efforts should be taken to locate the cause of contamination. When conditions responsible for unsatisfactory samples have been corrected, daily samples from the same point or points should be collected as soon as possible and examined until the results from at least two consecutive samples show that the water is bacteriologically satisfactory.

Experience has demonstrated that a minimum of two samples per month, preferably one sample semi-monthly, should be collected from each recreational area water supply for bacteriological examination during the operating season. Water supplies requiring complete treatment and those serving large developments should be sampled more often, the frequency to be governed by the results of sanitary surveys, the judgment of supervising health authorities, and the criteria outlined in the Drinking Water Standards.

Samples should be collected for chemical analysis from existing sources of supply, preferably annually, to determine if there has been any change in the chemical characteristics that may affect the quality of the supply and degree of treatment needed. However, if there is some suspicion that the concentrations of chemical substances exceeds the limits indicated in the Drinking Water Standards, samples should be collected for chemical analysis more frequently. When experience and available evidence based on laboratory results indicate that the chemical characteristics of a supply are consistently within the limits of the Drinking Water Standards, a maximum period not exceeding 3 years is prescribed in sampling for chemical analysis.

SANITARY SURVEY

A sanitary survey should be conducted by persons trained and competent in environmental sanitation and the epidemiology of waterborne diseases. In connection with a proposed supply, the sanitary survey should be made in conjunction with the collection of initial engineering data covering the development of the source and its capacity to meet existing and future demands. The survey should include the detection of all health hazards and an evaluation of their present and future significance. Sanitary surveys of existing water supply systems should preferably be made annually or at a frequency compatible with the control of the health hazards and maintenance of water in accordance with the Drinking Water Standards. Information obtained from a sanitary survey is essential to complete interpretation of bacteriological examination results and frequently the chemical data.

WATER TREATMENT

The water supply should be obtained from the most desirable source which is feasible, and efforts should be made to prevent or control pollution of the source. If the source is not adequately protected by natural means, the supply should be adequately protected by treatment. Adequate protection by treatment means any one or combination of the controlled processes of coagulation, sedimentation, absorption, filtration, and disinfection or other processes which produce water consistently meeting the requirements of the Drinking Water Standards. Proper supervision of the water supply system, especially treatment by well-trained, skilled, and competent operators, is essential to maintain water quality. Water treatment facilities should be protected from vandalism and tampering by unauthorized persons. Since disinfection may be the only method of treatment in recreation areas, and is frequently the final step in most treatment processes, proper supervision and control of disinfection is essential to maintain water quality. The following requirements of chlorination control emphasize the importance of this facet of water treatment.

Chlorination Control

Chlorination equipment should be selected, installed, and operated so that continuous and effective disinfection is secured under required local conditions. Chlorine should be applied continuously to untreated or filtered water at a point where thorough and rapid mixing with the treated water is effected. Unless bacteriological and other tests indicate the need for maintaining higher minimum concentrations of residual chlorine, the following requirements should prevail:

1. When simple chlorination is used for disinfection, at least 0.2 part per million (ppm) of free residual chlorine should be in contact with the water for not less than 20 minutes before the treated water reaches the first consumer beyond the point of chlorine application. In general it is desirable to maintain a free chlorine residual of not less than 0.05 to 0.10 ppm at distant points in the distribution system.
2. When chloramine treatment is used, at least 2.0 ppm of residual chlorine should be maintained after 3 hours' contact before the treated water reaches the first consumer, and 1.0 to 2.0 ppm residual chlorine should be maintained at all points in the distribution system.
3. When "breakpoint" chlorination is being considered, the health authority having jurisdiction should be contacted regard-

ing the procedure to be followed in initiating this method of disinfection.

At times of threatened, or prevalent outbreaks of waterborne disease such as during floods or other disaster conditions, a higher residual chlorine should be maintained in all parts of the distribution system, regardless of tastes or odors in the delivered water. Similar measures should be taken when any lapse in the normal efficiency of treatment is encountered. The amount of residual chlorine needed should be based on the recommendations of the health authority having jurisdiction over the area.

Special care should be taken to maintain a detailed and accurate record of chlorination and the results thereof. Such a record should show—

(a) Rate flow of water treated.
(b) Gross weight of chlorine cylinder or container in use.
(c) Weight of chlorine used for 24 hours.
(d) Setting of chlorinator.
(e) Time of making tests and results of residual chlorine tests.

Superchlorination-Dechlorination

In some small water supply systems, sudden increased demands of water use and the relatively short distance between the point of chlorine application and the first water tap does not allow sufficient contact time for simple chlorination procedures to be effective. This problem can be overcome by means of superchlorination-dechlorination. By this method chlorine is added to the water in increased amounts (superchlorination) to provide a minimum free chlorine residual of 3.0 ppm for a minimum contact period of 5 minutes, followed by the removal of excess chlorine (dechlorination) to eliminate objectionable chlorine tastes. Dechlorination can be accomplished by passing the water through activated carbon filters or by other commercially available methods and equipment.

DISTRIBUTION SYSTEM

Delivery of a safe water supply depends upon the protection of the water in the distribution system. Minimum protection in the distribution system should include programs which result in: provision of sufficient and safe materials and equipment to treat and distribute the water; prevention of health hazards; preventing loss of pressure because of overdraft in excess of the system's capacity; routine testing of water samples and frequent sanitary surveys of the water system to evaluate the adequacy of protection and disinfection of water mains, storage facilities, and other equipment after each installation, repair, or other modification which may have subjected them to possible contamination.

Many failures to meet the bacteriological requirements of the Drinking Water Standards which are directly related to the distribution system are caused by: (1) insufficient treatment at point of production, (2) cross-connections, (3) distribution system storage facilities not properly protected or adequately covered, (4) inadequate water mains and appurtenance disinfection, unsatisfactory water main constructed conditions and main joint-packing contamination, (5) sewer and water mains in close proximity, (6) blowoffs and vacuum or air relief valves improperly constructed or located, (7) negative pressures in distribution system, and (8) after growths in water mains and reservoirs.

DISINFECTION AND FLUSHING OF SYSTEM

Water from newly constructed or existing water supply systems which have been repaired or reconstructed may show unsatisfactory sanitary quality upon bacteriological examination. This is usually due to contamination from equipment, material, or surface water which may be introduced into the system during construction and repair. Water systems should be always thoroughly flushed to clear the system of dirt and debris, followed by disinfection to remove all traces of contamination following construction or repair work. This procedure should also be followed for water distribution systems drained for the winter. Disinfection should be done in accordance with the "Procedure for Disinfecting Water Mains,"[7] prepared by the Amer-

Figure 8.—Well pumphouse and storage tank.

ican Water Works Association. All wells and springs should be disinfected after construction or major repair in accordance with the guidelines contained in the "Manual of Individual Water Supply Systems." [8]

EMERGENCY DISINFECTION OF WATER IN THE FIELD [8]

When it is not possible to transport a sufficient supply of water for drinking purposes from approved sources of supply for field trips by hikers, horseback riders, fishermen and campers in wilderness area, plans should be made for the emergency disinfection of water in the field.

There are two general methods by which small quantities of water can be effectively disinfected. *Boiling* is the most effective method by which water can be made bacteriologically safe to drink. Another method is chemical treatment. If correctly applied, certain chemicals will make most waters safe for drinking and culinary purposes.

When emergency disinfection is necessary, the physical condition of the water must be considered. The effectiveness of disinfection will be reduced in water that is turbid. Consequently turbid or colored water should be allowed to settle and then filtered through a clean cloth, and the clean water drawn off for disinfection. Water prepared for disinfection should be stored only in clean, tightly covered, noncorrodible containers.

METHODS OF EMERGENCY DISINFECTION

1. *Boiling.* Vigorous boiling for 1 full minute will kill any disease-causing bacteria present in water. The flat taste of boiled water can be improved by pouring it back and forth from one container into another, by allowing it to stand for a few hours, or by adding a pinch of salt to each quart of water boiled.

2. *Chemical Treatment.* When boiling is not practical, chemical disinfection should be used. The two chemicals commonly used are iodine and chlorine.

(*a*) *Iodine*

(1) *Tincture of Iodine.* Common household iodine from the medicine chest or first-aid package may be used to disinfect water. Add 5 drops of 2 percent U.S. Pharmaceutical (U.S.P.) tincture of iodine to each quart of clear water, and for turbid water add 10 drops and let the solution stand for at least 30 minutes.

(2) *Iodine Tablets.* Commercially prepared iodine tablets containing the necessary dosage for drinking water disinfection can be purchased at drug and sporting goods stores. They should be used according to the instructions. When instructions are not

available, use one tablet for each quart of water to be purified. After thorough mixing, allow the water to stand for 30 minutes before being used.

(*b*) *Chlorine*

(1) *Chlorine Bleach.* Common household bleach contains a chlorine compound which will disinfect water. The procedure to be followed is usually written on the label. When the necessary procedure is not given, one should find the percentage of available chlorine on the label and use the information in the following table as a guide.

Available chlorine (percent)	Drops to be added per quart	
	Clean water	Cloudy water
1	10	20
4–6 *	2	4
7–10	1	2
If not known	10	20

* Common household laundry bleach.

The treated water should be mixed thoroughly and allowed to stand for 30 minutes. The water should have a slight chlorine odor or taste; if not, repeat the dosage and allow the water to stand for an additional 15 minutes. If the treated water has too strong a chlorine taste, it can be made more palatable by allowing the water to stand exposed to the air for a few hours or by pouring it from one clean container to another several times.

(2) *Chlorine Tablets.* Chlorine tablets containing the necessary dosage for drinking water disinfection can be purchased commercially. These tablets are available from drug and sporting goods stores and should be used as stated in the instructions on the label. When instructions are not available, use one tablet for each quart of water to be purified.

Water used for drinking, cooking, making any prepared drink, or brushing the teeth should be properly disinfected.

DRINKING FOUNTAINS

Drinking fountains should meet requirements adopted by the Joint Committee on Plumbing of the American Public Health Association and the Conference of State Sanitary Engineers. A copy of these requirements is outlined in appendix A.

Table 1.—*Planning guide for water use* [8]

Types of establishments	Gallons per day
Airports (per passenger)	3–5
Apartments, multiple family (per resident)	60
Bathhouses (per bather)	10
Camps:	
Construction, semipermanent (per worker)	50
Day with no meals served (per camper)	15
Luxury (per camper)	100–150
Resorts, day and night, with limited plumbing (per camper)	50
Tourist with central bath and toilet facilities (per person)	35
Cottages with seasonal occupancy (per resident)	50
Courts, tourist with individual bath units (per person)	50
Clubs:	
Country (per resident member)	100
Country (per nonresident member present)	25
Dwellings:	
Boardinghouses (per boarder)	50
Additional kitchen requirements for nonresident boarders	10
Luxury (per person)	100–150
Multiple family apartments (per resident)	40
Roominghouses (per resident)	60
Single family (per resident)	50–75
Estates (per resident)	100–150
Hotels with private baths (2 persons per room)	60
Hotels without private baths (per person)	50
Institutions other than hospitals (per person)	75–125
Hospitals (per bed)	250–400
Laundries, self-serviced (gallons per washing; i.e., per customer)	50
Livestock (per animal):	
Cattle (drinking)	12
Dairy (drinking and servicing)	35
Goat (drinking)	2
Hog (drinking)	4
Horse (drinking)	12
Mule (drinking)	12
Sheep (drinking)	2
Steer (drinking)	12
Motels with bath, toilet, and kitchen facilities (per bed space)	50
With bed and toilet (per bed space)	40
Parks:	
Overnight with flush toilets (per camper)	25
Trailers with individual bath units (per camper)	50
Picnic:	
With bath houses, showers, and flush toilets (per picnicker)	20
With toilet facilities only (gallons per picnicker)	10

Table 1.—*Planning guide for water use*[1]—Continued

Types of establishments	Gallons per day
Poultry:	
Chickens (per 100)	5–10
Turkeys (per 100)	10–18
Restaurants with toilet facilities (per patron)	7–10
Without toilet facilities (per patron)	2½–3
With bars and cocktail lounge (additional quantity per patron)	2
Schools:	
Boarding (per pupil)	75–100
Day with cafeteria, gymnasiums, and showers (per pupil)	25
Day with cafeteria but no gymnasiums or showers (per pupil)	20
Day without cafeteria, gymnasiums, or showers (per pupil)	15
Service stations (per vehicle)	10
Stores (per toilet room)	400
Swimming pools (per swimmer)	10
Theaters:	
Drive-in (per car space)	5
Movie (per auditorium seat)	5
Workers:	
Construction (per person per shift)	50
Day (school or offices per person per shift)	15

Chapter V

Sewage Disposal

Safe disposal of human and domestic wastes in recreational areas is necessary for the preservation of the surface and ground waters and the restoration of such waters to the best possible condition consistent with the public health and welfare. Proper sewage disposal assists in the propagation and preservation of fish and wildlife, and is essential to protect the visting public, employees, and nearby communities from diseases transmitted through sewage.

Sewerage systems and sewage treatment facilities must have adequate capacity, be capable of providing sufficient treatment, and be economical to construct, operate, and maintain.

The goal of Federal and State water pollution control authorities in conducting pollution abatement activities is to protect and enhance the capacity of the water resources to serve the widest possible range of human needs. Thus a positive policy of keeping waters as clean as possible, as opposed to a policy of attempting to use the full capacity of water for waste assimilation, is essential.

Seaonal operation and shutdowns, wide fluctuations in the quantity of sewage generated because of varying or heavy weekend visitor use, and detached or distant locations from normal repair and maintenance services are unusual problems associated with recreational areas. These difficulties must be considered in the design to insure adequate plant capacity, sufficient treatment, and still be economical to construct, operate, and maintain.

WATER-CARRIAGE SEWAGE-DISPOSAL SYSTEMS

Where posible in recreation areas the provision of a water-carriage system of sewage disposal is most desirable to remove the liquid wastes from flush toilets and other modern plumbing fixtures. This is accomplished by connecting to an existing public sewerage system where adequate treatment facilities have been provided. Where a public sewerage system is not available, a private system should be designed for the area under consideration. During the planning stage, the health or water pollution control authorities having jurisdiction over the area should be contacted to determine the degree of sewage treatment which will be needed to meet pollution abatement standards for the area and to assist in locating suitable waste discharge points. Where possible, treatment facilities and outfalls should be isolated, particularly with regard to the proximity of developed areas.

A preliminary study by a qualified sanitary engineer is desirable for the development of a sound and economical plan for a sewage works project. The study should justify the need for the project, what it will accomplish, and suggest alternate plans where two or more solutions exist for a particular problem. The engineering report should be based on field surveys and careful consideration of other factors which may influence the design or construction, and should be submitted to the approving authorities having statutory jurisdiction for review and recommendation prior to the preparation of final design plans and specifications.

SEWAGE WORKS

Sewage works should be designed on the basis of the waste water volumes from the various installations of the recreation area for the

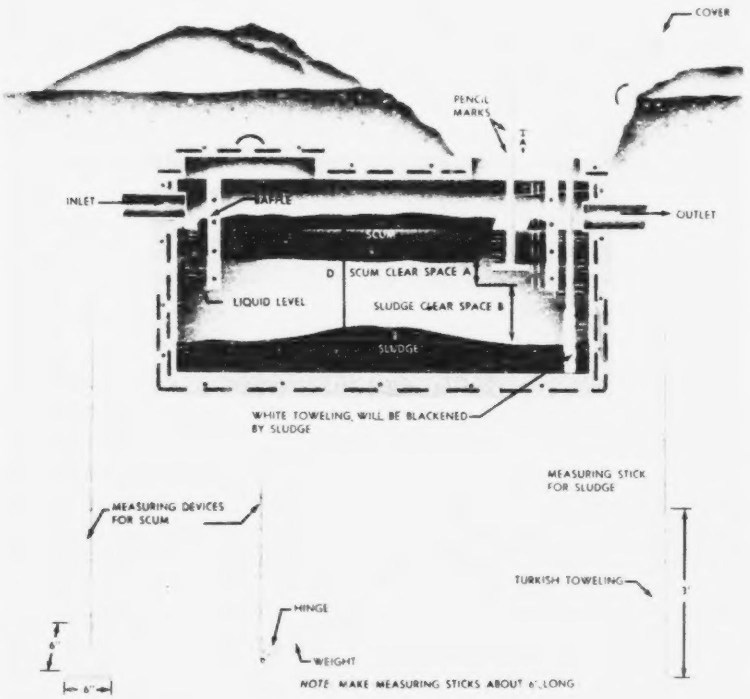

COVER
PENCIL MARKS
A
INLET
BAFFLE
OUTLET
SCUM
D
SCUM CLEAR SPACE A
LIQUID LEVEL
SLUDGE CLEAR SPACE B
SLUDGE
WHITE TOWELING, WILL BE BLACKENED BY SLUDGE
MEASURING STICK FOR SLUDGE
MEASURING DEVICES FOR SCUM
TURKISH TOWELING
3'
HINGE
6"
WEIGHT
6"
NOTE: MAKE MEASURING STICKS ABOUT 6' LONG

Figure 9.—Devices for measuring sludge and scum.

estimated ultimate development, except in considering those units of the system such as the number of filters, settling tanks, digesters and sludge drying beds that can be readily increased as the recreation area expands. The degree of treatment required should be based upon the size, usage, and character of the receiving body of water and upon the volume and strength of sewage to be treated. In order to remove settleable solids and to prevent the formation of sludge banks immediately below the sewer outlet, at least primary treatment should be provided in all areas, regardless of the size and character of the receiving body of water. Chlorination of primary treatment plant effluent is generally required to destroy pathogenic bacteria.

Where there is an existing sewerage system, data on the volume and the strength of sewage should accompany the report, for use in designing facilities. In cases of proposed systems where flows cannot be measured, consideration should be given to the figures presented in table 2 covering quantities of sewage for various types of developments. Records of quantities of sewage flow from similar types of developments are also useful in designing new facilities. Allowances should be made for ground water infiltration.

*Table 2.—Quantities of sewage water**

Recreational facility:	*Gallons/person/day*
1. Campgrounds or travel trailer parks with central comfort stations	35
2. Small dwellings and cottages with seasonal occupancy	50
3. Hotels with private baths (2 persons per room)	60
4. Motels with bath, toilet, and kitchen wastes	50
5. Motels (per bed space)	40
6. Single-family dwellings	50–75
7. Picnic parks (toilet wastes only) (gallons per picnicker)	5
8. Picnic parks with bathhouses, showers, and flush toilets	10
9. Restaurants (kitchen wastes/meal served)	2½–3
10. Restaurants (toilet and kitchen wastes/person)	7–10
11. Swimming pools and bathhouses	10
12. Day camps (no meals served)	15
13. Work or construction camps (semipermanent)	50
14. Luxury camps	*100

*Modern developments may include: (1) Central lodge with rooms for overnight guests, restaurant and bar; (2) adjoining cabins; (3) complete laundry facilities; (4) garbage grinders for the disposal of garbage to the sewerage system; and (5) private bath in all rooms and cabins.

Many of the recreational areas in cold climates operate on a seasonal basis, where the utilities must be drained to prevent damage by freezing during the winter months. When a proposed development will operate under these conditions, the disposal plant should be designed accordingly.

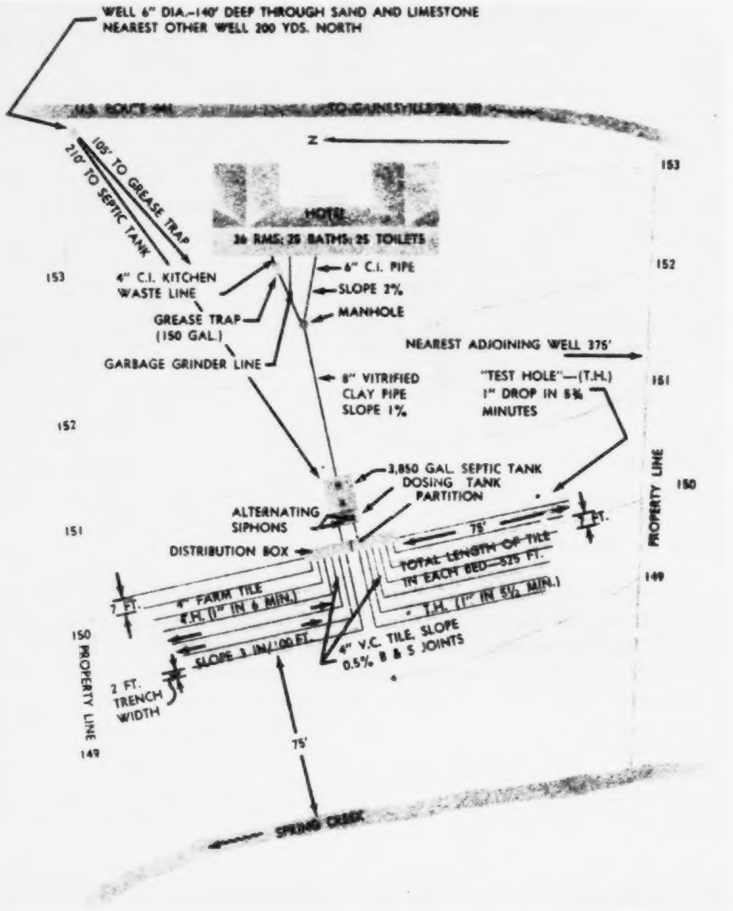

WELL 6" DIA.–140' DEEP THROUGH SAND AND LIMESTONE
NEAREST OTHER WELL 200 YDS. NORTH
U.S. ROUTE 441
TO GAINESVILLE
N
105' TO GREASE TRAP
210' TO SEPTIC TANK
HOTEL
26 RMS; 25 BATHS; 25 TOILETS
153
153
4" C.I. KITCHEN WASTE LINE
GREASE TRAP (150 GAL.)
GARBAGE GRINDER LINE
6" C.I. PIPE
SLOPE 2%
MANHOLE
152
NEAREST ADJOINING WELL 375'
8" VITRIFIED CLAY PIPE SLOPE 1%
"TEST HOLE"—(T.H.) 1" DROP IN 5½ MINUTES
151
152
3,850 GAL. SEPTIC TANK
DOSING TANK
PARTITION
ALTERNATING SIPHONS
150
151
DISTRIBUTION BOX
75'
7 FT.
PROPERTY LINE
TOTAL LENGTH OF TILE IN EACH BED—525 FT.
149
4" FARM TILE
T.H. (1" IN 6 MIN.)
7 FT.
T.H. (1" IN 5½ MIN.)
150
PROPERTY LINE
SLOPE 3 IN./100 FT.
4" V.C. TILE, SLOPE 0.5%, B & S JOINTS
2 FT. TRENCH WIDTH
149
75'
SPRING CREEK

Figure 10.—Typical layout plan of a subsurface sewage disposal system.

SEPTIC TANKS AND SUBSURFACE DISPOSAL SYSTEMS

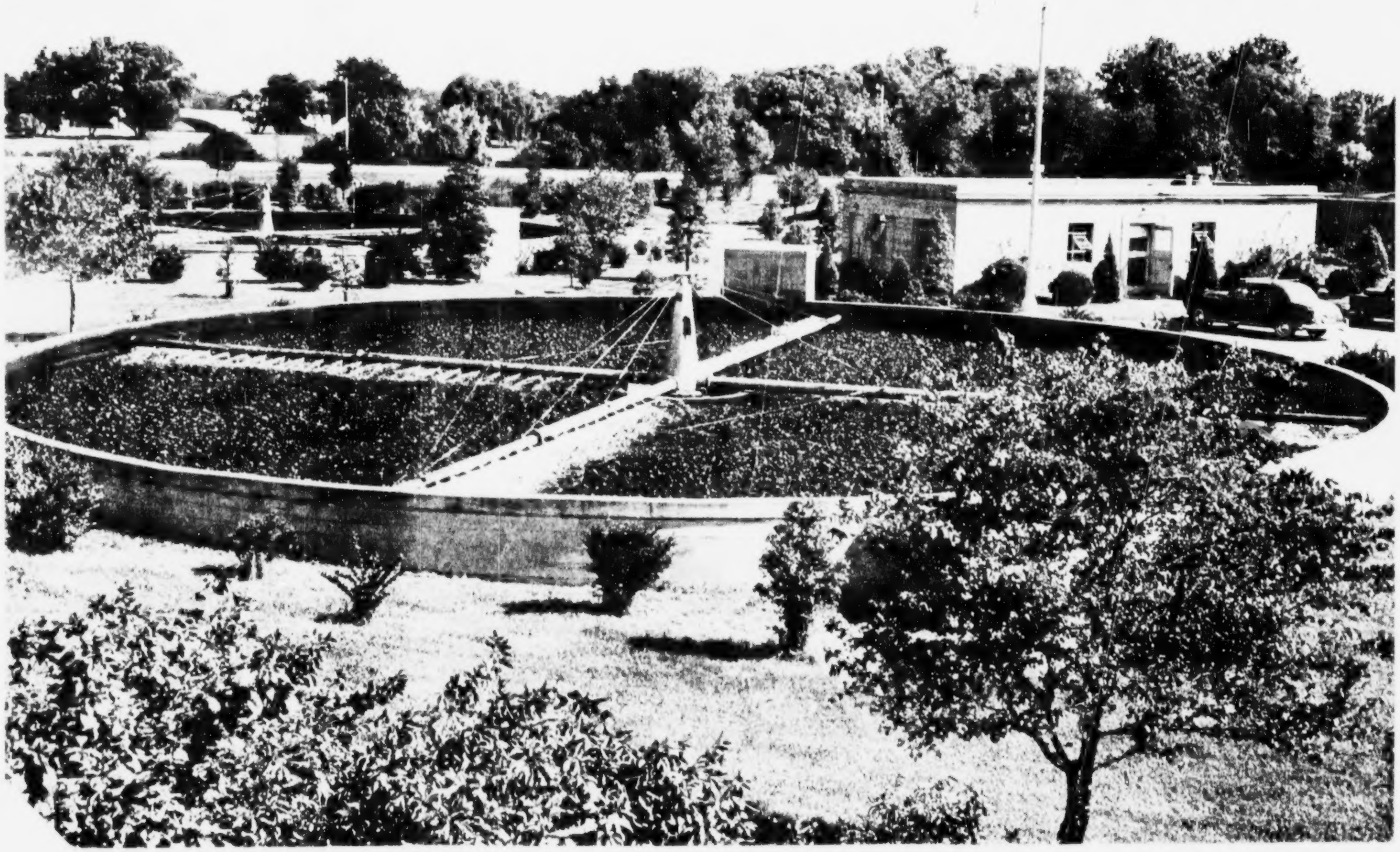
When the volume of sewage is limited and the terrain and soil are suitable for disposal of a septic tank effluent by means of subsurface disposal, the installation of a system consisting of septic tank and subsurface disposal field may be the most economical and practical method for the disposal of domestic wastes in recreational areas.

The results of satisfactory percolation tests should always be available before a disposal plant of this type is designed. Criteria for the design of septic tanks for large and small installations are presented in the "Manual of Septic-Tank Practice." Public Health Service Publication No. 526.[9]

Septic tanks and subsurface disposal fields should be located where they cannot contaminate any well, spring, or other source of water supply. Underground contamination may travel in any direction and for considerable distances, unless filtered effectively. Underground pollution usually moves in the same general direction as the normal movement of the ground water in the locality. Ground water moves in the direction of the slope or gradient of the water table; i.e., from the area of higher water table to areas of lower water table. In general, the water table follows the general contour of the ground surface. For this reason, septic-tank systems should be located downhill from wells, springs and infiltration galleries. No part of the septic-tank system should be closer than 50 feet from any source of water supply and greater distances are always preferred where possible.

The septic tank should not be located within 5 feet of any building. The septic-tank system should not be located in swampy areas, or in areas subject to flooding. In general, the tank should be located where the largest possible area will be available for the disposal field. Considerations should also be given to the location from the standpoint of cleaning and maintenance. Where a sewer system may be installed at a future date, provisions should be made in the connecting line to the tank for future connection to the proposed sewer system.

Contrary to popular belief, septic tanks do not accomplish a high degree of bacteria removal. Although the sewage undergoes treatment in passing through the tank, this does not mean that infectious agents will be removed; thus septic-tank effluents cannot be considered safe. The liquid discharged from a tank is, in some respects, more objectionable than that which goes in; i.e., it is septic and malodorous. The purpose of a septic tank is primarily to condition the sewage, so that it may be more readily percolated into the subsoil of the ground. This is accomplished by removal of solids, biological treatment, and sludge and scum storage. The functional operation of septic tanks is not improved by the addition of disinfectants, chemicals or other additives.



Capacity is one of the most important considerations in septic-tank design. Studies have proved that liberal tank capacity is not only important from a functional standpoint but is also advantageous for the storage of large volumes of sludge and scum, thus reducing cleaning intervals. The "Manual of Septic-Tank Practice"[9] recommends a minimum tank capacity of 750 gallons for a single-family dwelling which is also required by most State and local health departments.

In recreation areas where plumbing in buildings must be drained to prevent freezing, the inlets to septic tanks that serve these buildings should be trapped below the liquid level of the tank to keep septic-tank gas from entering the building through trapped outlets that have been drained.

Experience has shown that septic tanks and subsurface disposal systems give satisfactory service for many years when properly designed, constructed, operated, and maintained. The principal reason for the unsatisfactory operation of many septic-tank systems is failure to inspect and clean tanks periodically.

Septic tanks should be cleaned before too much sludge or scum is allowed to accumulate. If either the sludge or scum approaches too closely to the bottom of the outlet device, particles will be scoured into the disposal field and will clog the system. Eventually, when this happens, liquid may break through to the ground surface, and the sewage may back up in the plumbing fixtures. When a disposal field is clogged in this manner, it is not only necessary to clean the tank but it also may be necessary to construct a new disposal field.

Septic tanks should be inspected at least once a year and cleaned when necessary. When a tank is inspected, the depth of sludge and scum should be measured in the vicinity of the outlet baffle. The tank should be cleaned if either: (*a*) The bottom of the scum mat is within approximately 3 inches of the bottom of the outlet device; or (*b*) sludge comes within the limits specified in table 3. (See fig. 9, p. 32.)

Septic tanks should be accessible to servicing trucks to facilitate the removal of sludge and scum by pumping of this material when necessary. When the sludge and scum are removed from a septic tank, the material should preferably be buried in uninhabited areas selected for this purpose, or approval obtained from responsible authorities to discharge the sludge into a sanitary sewer system. These wastes should never be emptied into storm drains or discharged into a watercourse.

Figure 11.—Trickling filter plant.

←

NON-WATER-CARRIAGE SEWAGE DISPOSAL FACILITIES

Where water is in short supply or unavailable, or when soil conditions are unsuitable for subsurface disposal of a septic-tank effluent, various facilities such as "Pullman," chemical, and burnout toilets, and pit privies, have been used for sewage disposal. These units are often used in isolated areas for small developments as a temporary expedient, or where the cost of a water-carriage system of sewage disposal cannot be justified or financed. Use of the "Pullman" type toilet in recreational areas involves the installation of the toilet in a conventional comfort station provided with sanitary facilities for both sexes. The comfort station is usually mounted over a watertight holding tank for the retention of wastes. The liquid wastes are discharged to a subsurface drain field or are pumped from the tank periodically and disposed of by burial or other approved means.

Chemical and burnout toilets are used where water is unavailable for the operation of modern sanitary facilities. These units generally include a watertight holding tank located below a building provided with seats and risers.

In the case of a chemical toilet, the holding tank is filled with water to a predetermined level to which a chemical, usually a caustic compound, is added. The purpose of the chemical solution is to break down the fecal matters, liquify the contents, and to mask odors. The wastes from the tank must be pumped out frequently and disposed of by burial or other approved means. There are no additives which eliminate or reduce the need to clean out the tank by pumping or manual removal.

The solid wastes in a burnout toilet collect on a metal grill mounted in the bottom of the holding tank, which allows the liquids to drain off to an adjoining leaching pit or title field. These units must be taken out of service periodically and the solid wastes burned out by means of fixed or portable burners.

Although chemical and burnout toilets serve a useful purpose, they present operation and maintenance problems. Accident hazards and odors are occassionally associated with their use and operation.

Installation of earthpit or masonry vault privies for developed areas such as campgrounds, picnic areas, etc., should be approved only where the installation of more modern sanitary facilities is considered impractical or as a temporary expedient. Recreational area developers should be encouraged to install water-carriage sewage disposal facilities for all recreational developments.

The following features of pit privy construction should be considered in connection with the design of sanitary pit privies for recreational areas:

1. The receptacle for storing human wastes should be flytight, rodentproof, and constructed in a manner and of such materials as to afford reasonable assurance of remaining flytight and rodentproof under ordinary conditions of use.

2. The unit should be located to prevent pollution of adjoining watercourses and domestic water supply sources, to prevent the contents from overflowing to the ground surface and surface water from flowing into the pit. If the tank is to be pumped periodically, it should be located so as to be accessible for servicing.

3. The unit should be constructed of such material and in such manner so as to prevent rapid deterioration, provide adequate capacity, and facilitate maintenance in a satisfactory manner under ordinary conditions of use.

4. Venting of the pit is desirable to provide a continuous escape of odors through a screened vent that extends from the pit through the roof or sides of the superstructure.

STABILIZATION PONDS

Stabilization ponds provide a satisfactory method of sewage disposal and have been demonstrated to be a practical, minimum-cost method of sewage treatment when properly designed, constructed, and operated. However, they should not be considered the solution for all sewage treatment needs.

The design of stabilization ponds is dependent on characteristics of the sewage flow, rainfall, evaporation, seepage, topography, and soil conditions. While the structural design is not complicated, a basic understanding of the biological and chemical processes is essential to a successful design. The health authorities having jurisdiction over the area should be contacted regarding the design criteria and degree of treatment that will be needed. The choice between the use of single-cell or multiple-cell ponds will be based on local conditions and downstream water use if the effluent will be discharging into a receiving body of water. The shape of all cells should be such that a uniform perimeter results. No islands or peninsulas should be used.

The pond site should be located at a practical distance away from developed areas with due respect to future expansion. Preference should be given to sites which will permit an unobstructed wind sweep across the ponds, especially in the direction of local prevailing winds. Locating ponds in watersheds receiving significant amounts of runoff water should be discouraged unless adequate provisions are made for storm water to bypass the ponds. Proximity of ponds to water supplies and other facilities subject to contamination should be critically evaluated to avoid creation of health hazards or other undersirable conditions.

Figure 12.—Waste stabilization pond.

Figure 13.—Pit privy.

The pond area should be enclosed with a suitable fence to exclude livestock and discourage trespassing. A vehicle access gate of sufficient width to accommodate mowing equipment should be provided. All access gates should be provided with locks. Appropriate signs should be provided along the fence around the pond to designate the nature of the facility and advise against trespassing. The optimum liquid waste depth will be influenced to some extent by the pond area, since circulation in larger installations permits greater liquid depth. The basic plan of operation may also influence depth. Facilities to permit operation at selected depths between 2 and 5 feet provide for operational flexibility. Where winter operation is necessary, the operating level can be lowered before ice formation and gradually increased to 5 feet by the retention of winter flows. In the spirng, the level can be lowered to any desired depth at the time surface runoff and dilution water are generally at a maximum. Shallow operation can be maintained during the spring with generally increased depths to discourage emergent vegetation. In the fall, the levels can be lowered and again be ready for retention of winter storage.

The need for daily maintenance of stabilization ponds is not as urgent as for other water-carriage sewage treatment systems. However, planned maintenance at regular intervals is essential in order to protect the dikes, keep weeds from growing in the shallow water, and to avoid the breeding of mosquitoes or other pests. Weeds and willows will grow in shallow water areas unless controlled by soil sterilization initially, and routine mowing. Dikes and structure should be inspected regularly for erosion from wind and rain or for burrowing by rodents.

Table 3.—*Allowable sludge accumulation* [9]

Liquid capacity of tank (gallons)	Liquid depth		
	3 feet	4 feet	5 feet
	Distance from bottom of outlet device to top of sludge, inches		
500	11	16	21
600	8	13	18
750	6	10	13
900	4	7	10
1,000	4	6	8

Chapter VI

Plumbing

Plumbing includes "the practice, materials, and fixtures used in the installation, maintenance, extension, and alterations of all piping, fixtures, appliances, and appurtenances in connection with any of the following: sanitary drainage or storm drainage facilities, the venting system, and the public or private water supply systems within or adjacent to any building structure, or conveyance; also the practice and materials used in the installation, maintenance, extension, or alteration of storm water, liquid waste, or sewage, and water supply systems of any premises to their connection with the public sewer system or other acceptable disposal facility." [10]

MINIMUM NUMBER OF PLUMBING FIXTURES

Adequate toilets, lavoratories, and other necessary plumbing fixtures should be provided for buildings in recreational areas for the convenience and comfort of visitors and employees. The desirable minimum number of plumbing fixtures is listed in table 4 for the types of buildings and occupancy specified.

MATERIALS

All materials used in the construction of any plumbing system, fixtures, or equipment should conform with the minimum standards of the National Plumbing Code ASA A40.8–1955 or as subsequently revised, or requirements which are substantially equivalent in State or local plumbing codes. All materials should be handled and installed so that the quality of the material is not impaired.

BACKSIPHONAGE AND CROSS-CONNECTIONS

Public health officials have long been concerned about cross-connections and backflow conditions in plumbing systems. There are numerous and well-documented cases where such connections have been responsible for contaminating drinking water supplies resulting in outbreaks of waterborne disease. Since humans are capable of emitting disease organisms with body wastes, the opportunities for waterborne disease outbreaks are present when there is any possibility that body wastes can enter drinking water supplies.

Those responsible for the construction and supervision of buildings in recreation areas should recognize that serious health hazards to drinking water supplies can result from plumbing system defects.

A cross-connection is any physical connection or arrangement between two otherwise separate piping systems, one of which contains potable water and the other water of unknown quality or questionable safety; or steam, gas, liquids, or other chemical substances whereby there may be a flow from one system to the other, the direction of flow depending on the pressure differential between the two systems. A backflow condition is simply any arrangement whereby backflow into the potable water system can occur.

Preventing cross-connection is obtained by recognition of the potential danger involved and regular surveillance of the plumbing system. Many who are experienced in piping installation often fail to recognize cross-connection possibilities. Plumbing systems are usually altered or extended, therefore a continuing program of cross-connection detection is recommended by health authorities.

NEW INSTALLATIONS

All plumbing to be installed in recreation areas should conform to the minimum requirements of the National Plumbing Code ASA A40.8—1955 or as revised subsequently, or requirements which are substantially equivalent in applicable State or local plumbing codes.

The National Plumbing Code is founded upon certain basic principles of environmental sanitation through properly designed, acceptably installed, and adequately maintained plumbing systems. Some of the details of plumbing construction may vary, but the basic sanitary and safety principles desirable and necessary to protect the health of people are the same everywhere. These basic principles listed in the code are outlined in appendix B for use in the interpretation of situations not covered in the body of the code.

EXISTING INSTALLATIONS

The correction of existing cross-connections or backflow connections should be undertaken as follows:

1. Eliminate immediately all direct connections between potable water supply piping and nonpotable water supply piping and plumbing drainage systems that are pollution possibilities.
2. Eliminate on a planned program basis all other plumbing hazards and always when replacement of fixtures is scheduled.

METHODS OF CORRECTING PLUMBING DEFECTS

Corrective or remedial action to eliminate cross-connections is handled by applying one of the well-known methods described below. More extensive definition and application of these methods is described in the National Plumbing Code.

1. *Airgap.* An airgap is the unobstructed vertical distance through the free atmosphere between the lowest opening from

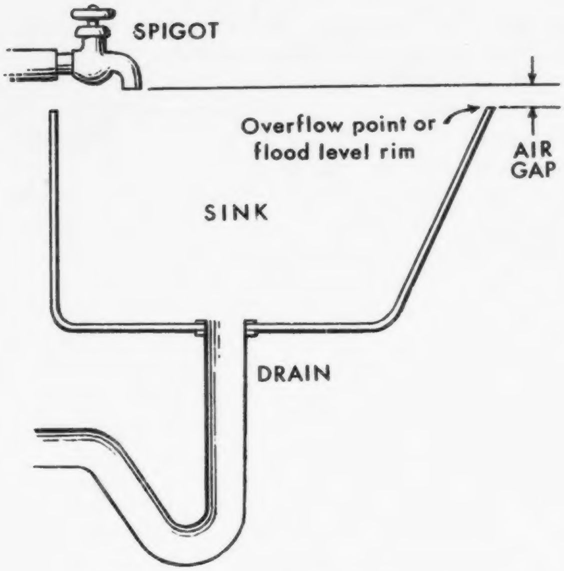

SPIGOT
Overflow point or flood level rim
AIR GAP
SINK
DRAIN

Figure 14.—Lavatory unit with an air gap water inlet.

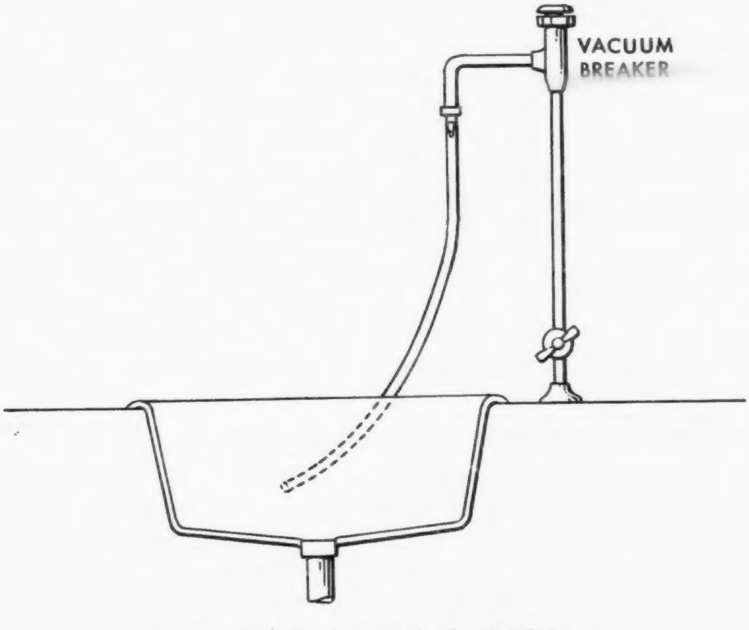

VACUUM BREAKER

Figure 15.—Typical vacuum breaker installation.

any pipe or faucet supplying water to a tank, plumbing fixture, or other device, and the flood level rim of the receptacle. Figure 14 shows the airgap technique applied to a lavatory installation. An airgap distance of at least twice the diameter of the effective opening of the supply pipe should be provided. In no case should this be less than the following[10]:

Effective opening size (inches)	Minimum airgap (inches)	
	When not affected by near wall	When affected by near wall
½ or less	1	1½.
More than ½ Up through ¾	1½	2¼.
More than ¾ Up through 1	2	3.
Greater than 1	2 times the effective opening.	3 times the effective opening.

2. *Non-pressure-type vacuum breaker.* A non-pressure-type vacuum breaker is a device used to protect all water connections not subject to backpressure when installed at or above a specified minimum accepted elevation and on the discharge side of the last control valve. Figure 15 shows the typical installation of this vacuum breaker.

3. *Backflow preventer—Reduced pressure zone type.* An assembly of differential valves and check valves, including an automatic opening port to the atmosphere to prevent backflow due to higher pressures on the discharge side of the assembly.

EXAMPLES OF CROSS-CONNECTIONS AND BACKFLOW CONNECTIONS

Examples of cross-connections and backflow connections which may be encountered in recreation areas include—

1. Direct connection of water supply to cooling or condenser systems in refrigerating or air-conditioning systems.
2. Drinking fountains with submerged water inlets or with the water-supply line passing through the drain.
3. Fish ponds with submerged inlets.
4. Fire hydrants with drain connection to sewers.
5. Frostproof waterclosets, whether or not the valve drains to the sewer or to the ground surrounding the sewer.
6. Kitchen and laundry fixtures with common waste and supply lines.

7. Lawns—underground water sprinkling systems without vacuum breaker.

8. Pump pits with drain connection to pump or sewer line.

9. Sinks with faucets or water inlets below the rim and sinks with loose hose connections not provided with a proper retractor.

10. Swimming pools with water supply inlets below the overflow line or having a physican connection between potable water and the recirculating system.

11. Water coolers improperly designed and using toxic refrigerant which may pollute the water supply.

12. Watercloset bowls equipped with flushometer valves or with flushing tanks with submerged-float-operated ballcocks.

13. Flushometer valves for toilet fixtures not protected with siphon breaker or air gap.

14. Ice cube machines with direct sewer connections or blackflow connections.

15. Soil and waste pipes passing above open water storage tanks, refrigerators, or food storage, and food preparation areas.

The manual on "Water Supply and Plumbing Cross-Connections" [11] has been produced as a tool for health officials, waterworks personnel, building maintenance foreman, plumbers, and many others. It defines, describes, and illustrates typical cross-connections and suggests simple methods and devices by which they may be eliminated without interfering with the functions of plumbing systems.

COMFORT STATIONS

It is generally conceded that comfort stations providing flush toilets, lavatories, or other facilities for the use of the public are among the most necessary structures built in recreation areas. While compactness and economy of construction are highly desirable, the design of a comfort station should be slanted toward the development of an efficient unit that will minimize the long-term maintenance and operational costs.

Permanent Construction

Comfort stations of permanent construction should be provided with an interior finish of moisture-resitant materials which will stand frequent washing and cleaning. The floors, walls, partitions, and other interior surfaces should be imperivous to water and easily cleanable. The use of ceramic tile floors and wainscot reduces maintenance costs and is believed by many to discourage vandalism.

Comfort stations should be well lighted, adequately ventilated, and properly protected from the weather. They need not be heated; however, when they are to be used during freezing weather conditions sufficient heat should be provided to prevent damage to plumbing. All exterior openings should be covered with 16-mesh screen. Windows should be placed above the eye level for privacy, if possible, otherwise translucent window glass will be needed. Outward-opening self-closing doors should also be used.

There is obvious saving in cost in grouping men's and women's toilet rooms under one roof. When this is done, the arrangement of separate entrances so that each section is suitably remote from the other is important. If on opposite sides of the building, the maximum desirable separation of approaches is obtained. The approaches and entrances should be clearly marked. A substantial soundproof partition should completely separate the two toilet rooms. A typical layout of a comfort station is shown in figure 16.

Plumbing fixtures should be provided in comfort stations as outlined in table 4. Soap and individual towels, or other means for drying hands, and trash containers should be provided. A safe and adequate water supply and an approved sewage disposal system are necessary requisites to the installation of a modern comfort station as described in chapters IV and V of this Guide. An estimate of the quantity of water needed for a comfort station is outlined in table 5, which gives the flow desirable for many common types of fixtures, and the average pressure necessary to provide this rate of flow.

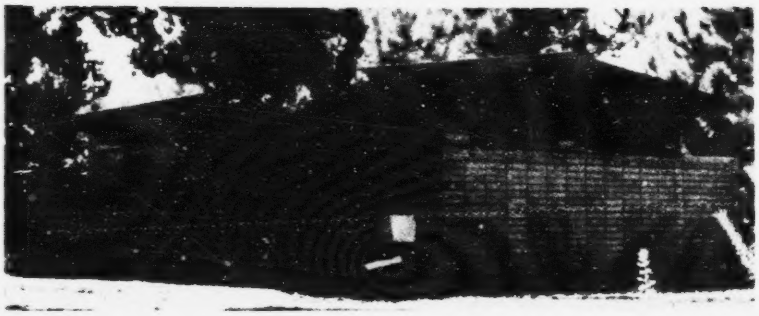
Mobile Comfort Stations

In many recreation areas, especially in and around large cities, mobile comfort stations have satisfactorily been used to provide adequate and essential facilities for large group gatherings. These units have been invaluable for use during short-term special events such as festivals, carnivals, and sporting events. Their quick and convenient service and mobility make them indispensable for many occasions.

These units are constructed with separate compartments for men and women. Each compartment is provided with soap, paper towels, and a trash receptacle. The following number of plumbing fixtures have been found adequate in units which have been used at Washington, D.C., events.

	Men	*Women*
Waterclosets	4	5
Urinals	2	--
Lavatories	2	2

Separate water and sewer connections are provided for direct service from a municipal water supply and sewerage system. Parking over a sewer manhole is a convenient way to obtain ready access to an existing sewerage system. A power connection must be provided, as lights in the units are necessary and discourage vandalism.



A comfort station of pleasing design and proportion intended for campgrounds, but one which might profitably be used at the smaller public swimming areas.

A fiberglass roof would make the interior brighter if this building were to be located in shaded areas.

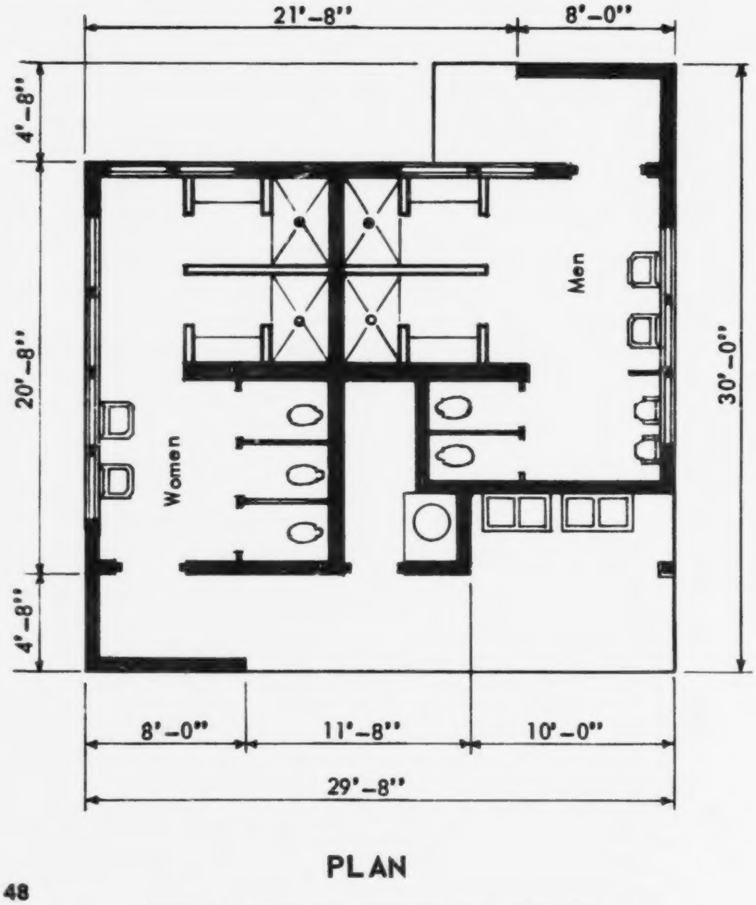

21'–8"
8'–0"
4'–8"
20'–8"
4'–8"
30'–0"
Men
Women
8'–0"
11'–8"
10'–0"
29'–8"
PLAN

Figure 16.—Layout of a permanent type comfort station.

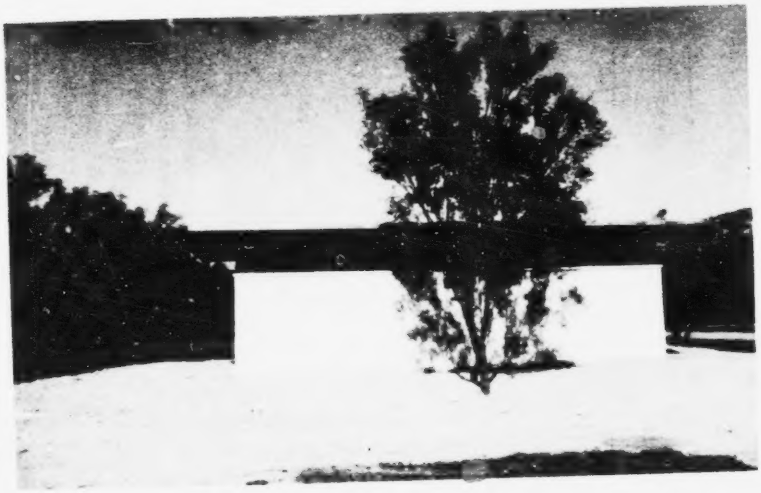


Figure 17.—Comfort station for campground.

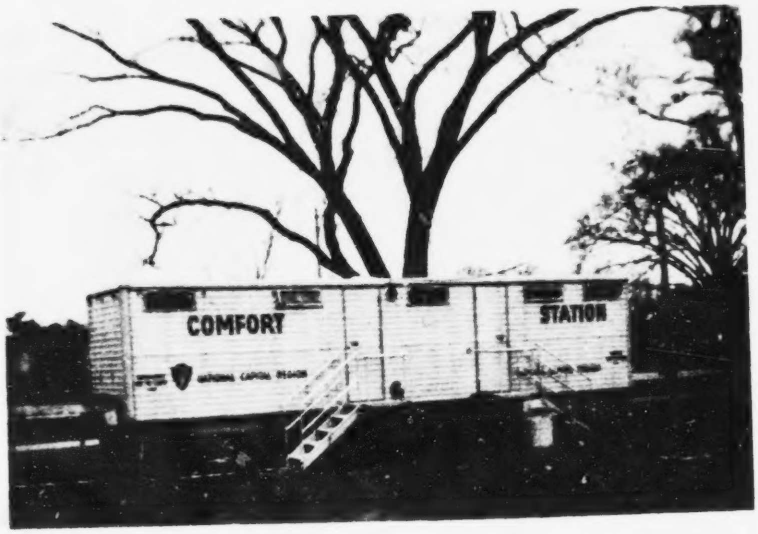

COMFORT
STATION
NATIONAL CAPITAL REGION

Figure 18. Mobile comfort station.

Table 4.—Minimum number of plumbing fixtures [10]

Type of building occupancy	Type of fixture								
	Waterclosets		Urinals		Lavatories		Bathtubs or showers	Drinking fountains**	Other fixtures
Assembly—places of worship.	*Number of persons* 150 women. 300 men	*Number of fixtures* 1 1	*Number of persons* 300 men*	*Number of fixtures* 1	1			1	
Auditoriums, theaters, and convention halls.	*Number of persons* 1–100 101–200 201–400	*Number of fixtures* 1 2 3	*Number of persons* 1–200 201–400 401–600	*Number of fixtures* 1 2 3	*Number of persons* 1–200 201–400 401–750	*Number of fixtures* 1 2 3			
	Over 400, add 1 fixture for each additional 500 men and 1 for each 300 women.		Over 600, add 1 fixture for each 300 men.*		Over 750, add 1 fixture for each 500 persons.			1 for each 300 persons.	1 slop sink.
Dormitories—school or labor, also institutional.	Men: 1 for each 10 persons. Women: 1 for each 8 persons.		1 for each 25 men. Over 150, add 1 fixture for each 50 men. *		1 for each 12 persons. (Separate dental lavatories should be provided in community toilet rooms. A ra-		1 for each 8 persons. For women's dormitories, additional bathtubs should be installed at the ratio	1 for each 75 persons.	Laundry trays, 1 for each 50 persons. Slop sinks, 1 for each 100 persons.

			tio of 1 dental lavatory to each 50 persons is recommended.)	of 1 for each 30 women. Over 150 persons, add 1 fixture for each 20 persons.		
Dwellings—1 and 2 family.	1 for each dwelling unit.	----------------	1 for each dwelling unit.	1 for each dwelling unit.	-------------	Kitchen sink, 1 for each dwelling unit.
Dwellings—multiple or apartment.	1 for each dwelling unit or apartment.	----------------	1 for each dwelling unit or apartment.	1 for each dwelling unit or apartment.	-------------	Kitchen sink, 1 for each dwelling unit or apartment. For apartment or multiple dwelling units in excess of 10 apartments or units, 1 double laundry tray for each 10 uinits or 1 automatc laundry washing machine for each 20 unit.

See footnotes at end of table.

Table 4.—*Minimum number of plumbing fixtures*—Continued

Type of building occupancy	Type of fixture									
	Waterclosets		Urinals		Lavatories		Bathtubs or showers		Drinking fountains **	Other fixtures
Public buildings, offices, business mercantile.	*Number of each sex*	*Number of fixtures*	Urinals may be provided in men's * toilet rooms in lieu of waterclosets but for not more than ⅓ of required number of waterclosets.		*Number of employees*	*Number of fixtures*	----------		1 for each 75 persons.	1 slop sink per floor.
	1–15	1			1–15	1				
	16–35	2			16–35	2				
	36–55	3			36–60	3				
	56–80	4			61–90	4				
	81–110	5			91–125	5				
	110–150	6			1 fixture for each additional 45 persons.					
	1 fixture for each additional 40 employees.									
Schools—elementary, secondary.	*Boys*	*Girls*					In gym or pool shower rooms, 1/5 pupils of a class.		1/100 pupils, but at least 1 per floor.	Slop sinks, 1 on each floor.
	1/40	1/35	1/30 boys		1/50 pupils					
	1/75	1/45	1/30 boys		1/50 pupils					
Working men, temporary facilities.	1/30 working men.		1/30 working men.		1/30 working men.		----------		1 fixture or equivalent for each 100 working men.	
Swimming pools. Based on maximum load.	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*	1 located in swimming pool area.	
	1/75	1/50	1/75	-------	1/100	1/100	1/50	1/50		
							minimum of 2.			

Table 4.—Minimum number of plumbing fixtures [13]

Type of building occupancy	Type of fixture							
	Water closets			Urinals		Lavatories		
	Number of sites	Number of fixtures		Number of sites	Number of fixtures	Number of sites	Number of fixtures	
		Male	Female				Male	Female
Comfort stations for campgrounds	1–20 21–30	1 2	2 3	1–20 21–30	1 2	1–20 21–30	1 2	1 2
	Number of car parking spaces	Number of fixtures		Number of car parking spaces	Number of fixtures	Number of car parking spaces	Number of fixtures	
		Male	Female				Male	Female
Comfort stations for picnic areas	1–40 41–80 81–120	1 2 3	2 4 6	1–40 41–80 81–120	1 2 3	1–40 41–80 81–120	1 2 3	1 2 3

A comfort station with good balance should contain 2 waterclosets, 2 lavatories, and 1 urinal for males; and 3 waterclosets and 2 lavatories for females. A sanistand substituted for 1 watercloset is desired for females. A comfort station should provide facilities for sites within a 300-foot radius.

* Where urinals are provided for women, the same number should be provided as for men.

**Drinking fountains should not be installed in toilet rooms.

These units are not provided with heating equipment because they are seldom used during cold weather. However, if cold weather use is necessary, skirt enclosures can be installed below and around the unit to protect the piping below the flow level and an electric heater used in this enclosure to prevent pipes from freezing.

Because of their weight, they must generally be kept on solid roadways to avoid becoming mired down in soft earth. It is also not practical to transport them over highways for long distances as pipe leaks and breaks will develop. A typical mobile comfort station is shown in figure 18.

Portable Toilets

Portable chemical toilets are very useful and provide economic toilet facilities for many occasions such as construction projects, parades, and other public events where large numbers of people congregate for a short period of time. These units are generally equipped with a toilet and urinal and are available for rental or lease from many commercial companies to include installation and routine servicing. Easily transported by truck, any number of these units can be dispersed rapidly to locations to meet the demands for emergency toilet facilities that meet public health standards. A typical unit is shown in figure 19.

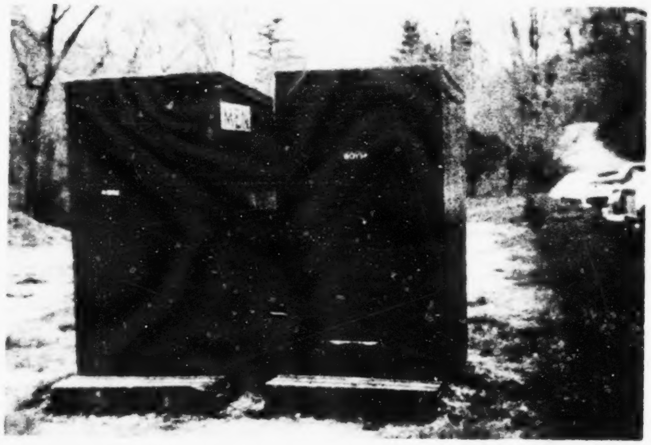


Figure 19.—Portable toilets.

Table 5.—*Rates of flow for certain plumbing and household fixtures*[16]

Location	Flow pressure[a] pounds per square inch (psi)	Flow rate—gallons per minute (gpm)
Ordinary basin faucet	8	2. 0
Self-closing basin faucet	8	2. 5
Sink faucet, ⅜ inch	8	4. 5
Sink faucet, ½ inch	8	4 5
Bathtub faucet	8	6. 0
Laundry tub faucet, ½ inch	8	5. 0
Shower	8	5. 0
Ballcock for closet	8	3. 0
Flush valve for closet	15	[b] 15–35
Flushometer valve for urinal	15	15. 0
Drinking fountains	15	0. 75
Sill cock—wall hydrant	10	5. 0

[a] Flow pressure is the pressure in the supply near the faucet or water outlet while the faucet or water outlet is wide open and flowing.

[b] Wide range due to variation in design and type of closet flush valves.

Chapter VII

Building and Housing Hygiene

Construction of new buildings and the operation and maintenance of existing buildings in recreational areas are specialized problems which require proper analysis and comprehensive coordinated planning by the landscape architect, architect, and engineer. Many recreational developments are communities unto themselves which involves the entire scope of community planning. Proper site selection and development and adequate design, construction, and maintenance of recreational area buildings is essential, so that the development will blend in and not mar the scenic and other values in the vicinity.

The scope of the public health aspects of housing involves the design and arrangement of the dwelling unit, the materials and methods of construction, the use of space by the occupants, the maintenance of the structures and dwelling areas, and the availability of community facilities and services.

Housing of good sanitary quality must provide for fulfillment of the physiological needs of man, which include: a thermal environment that not only is conducive to good health but is comfortable and promotes the efficiency of living; air that is chemically pure and free from objectionable odors; humidity that is healthful and comfortable; and air movement that will assist in maintaining the desired thermal conditions and air purity and will provide for the necessary air changes. Housing should be free of noise that may impair health. Lighting should be quantitatively and qualitatively adequate including both natural and artificial sources.

All buildings and dwelling units should be constructed in accordance with the minimum requirements of the "Proposed Housing Ordinance"[13] prepared by the Committee on the Hygiene of Housing of the American Public Health Association or requirements that are substantially equivalent. The "Basic Principles of Healthful Housing,"[14] prepared by the same committee, is another good reference in the field of housing. Those concerned with the design, operation, and maintenance of public buildings should consult these references for more complete coverage of this subject. Plans and specifications covering housing, dormitories, labor camps, hotels, restaurants, and similar facilities should be submitted to the appropriate authorities having jurisdiction for review and recommendations. Some of the more important aspects of housing not covered elsewhere in this Guide are outlined below:[13]

A. *Light, Ventilation, and Heating*

1. Every habitable room should have at least one window or skylight facing directly to the outdoors. The minimum total window area, measured between stops, for every habitable room should be 10 percent of the floor area of such room. Whenever walls or other portions of structures face a window of any such room and such light-obstruction structures are located less than 3 feet from the window and extend to a level above that of the ceiling of the room, such a window, should not be deemed to face directly to the outdoors and should not be included as contributing to the required minimum total window area. Whenever the only window in a room is a skylight-type window in the top of such room, the total window area of such skylight should equal at least 15 percent of the total floor area of such room.
2. Every habitable room should have at least one window or skylight which can easily be opened, or such other device as will adequately ventilate the room. The total of openable window area in every habitable room should be equal to at least 45 percent of the minimum window area size or minimum skylight-type window size, as required in item I, except where there is supplied some other device affording adequate ventilation and approved by the health or other authority having jurisdiction.
3. Every bathroom and watercloset compartment should comply with the light and ventilation requirements for habitable rooms contained in items 1 and 2, except that no window or skylight should be required in adequately ventilated bathrooms and watercloset compartments equipped with a mechanical ventilation system which is approved by the health or other authority having jurisdiction.
4. Where there is electric service available, every habitable room of such dwelling should contain at least two separate floor- or wall-type electric convenience outlets, or one such convenience outlet and one supplied ceiling-type electric light fixture; and every watercloset compartment, bathroom, laundry room, furnace room, and public hall should contain at least one supplied ceiling- or wall-type electric light fixture. Every such outlet and fixture should be properly installed, should be maintained in good and safe working condition, and should be connected to the source of electric power in a safe manner.
5. Every dwelling should have heating facilities which are properly installed, are maintained in safe and good working condition, and are capable of safely and adequately heating all habitable rooms, bathrooms, and watercloset compartments in very dwelling unit located therein to a temperature of at least 70° F., at a distance 3 feet above floor level, under ordinary minimum winter conditions.
6. Every public hall and stairway in every multiple dwelling containing five or more dwelling units should be adequately lighted at all times. Every public hall and stairway in structures devoted solely to dwelling occupancy and containing not more than four dwelling units may be supplied with conveniently located light switches, controlling an adequate lighting system which may be turned on when needed, instead of full-time lighting.
7. During that portion of each year when it is necessary to protect against mosquitoes, flies, and other insects, every door opening directly from a dwelling unit to outdoor space should have supplied screens and a self-closing device; and every window or other device with openings to outdoor space, used or intended to be used for ventilation should likewise be supplied with screens: *Provided*, That such screens should not be required during such period in rooms deemed by the health authority to be located high enough in the upper stories of buildings as to be free from such insects. Screening material should not be less than 16 mesh to the inch or equivalent.

8. Every basement or cellar window used or intended to be used for ventilation, and every other opening to a basement which might provide an entry for insects and rodents, should be supplied with a screen or such other device as will effectively prevent their entrance.

B. *Safe and Sanitary Maintenance*

1. Every foundation, floor, wall, ceiling, and roof should be reasonably weathertight, watertight, and rodentproof; should be capable of affording privacy; and should be kept in good repair.
2. Every window, exterior door, and basement hatchway should be reasonably weathertight, watertight, and rodentproof; and should be kept in sound working condition and good repair.
3. Every inside and outside stair, every porch, and every appurtenance thereto should be so constructed as to be safe to use and capable of supporting the load that normal use may cause to be placed thereon; and should be kept in sound condition and good repair.
4. Every plumbing fixture and water and waste pipe should be properly installed and maintained in good sanitary working condition, free from defects, leaks, and obstructions.
5. Every watercloset compartment floor surface and bathroom floor surface should be constructed and maintained so as to be reasonably impervious to water and so as to permit such floor to be easily kept in a clean and sanitary condition.
6. Every supplied facility, piece of equipment, or utility should be so constructed or installed that it will function safely and effectively, and should be maintained in satisfactory working condition.

C. *Space, Use, and Location*

1. Every dwelling unit should contain at least 150 square feet of floorspace for the first occupant thereof and at least 100 additional square feet of floorspace for every additional occupant thereof, the floorspace to be calculated on the basis of total habitable room area.
2. In every dwelling unit of two or more rooms, every room occupied for sleeping purposes by one occupant should contain at least 70 square feet of floorspace, and every room occupied for sleeping purposes by more than one occupant should contain at least 50 square feet of floorspace for each occupant thereof.
3. No dwelling or dwelling unit containing two or more sleeping rooms should have such room arrangements that access to a bathroom or watercloset compartment intended for use by occupants of more than one sleeping room can be had only by going through another sleeping room; nor should room arrangements be such that access to sleeping rooms can be had only by going through another sleeping room or a bathroom or watercloset compartment.
4. At least one-half of the floor area of every habitable room should have a ceiling height of at least seven feet; and the floor area of that part of any room where the ceiling height is less than five feet should not be considered as part of the floor area in computing the total floor area of the room for the purpose of determining the maximum permissible occupancy thereof.
5. No cellar space should be used as a habitable room or dwelling unit.
6. No basement space should be used as a habitable room or dwelling unit unless—
   - (*a*) The floor and walls are impervious to leakage of underground and surface runoff water and are insulated against dampness;
   - (*b*) The total of window area in each room is equal to at least the minimum window area sizes as required in item A.1 above;
   - (*c*) Such required minimum window area is located entirely above the grade of the ground adjoining such window area; and

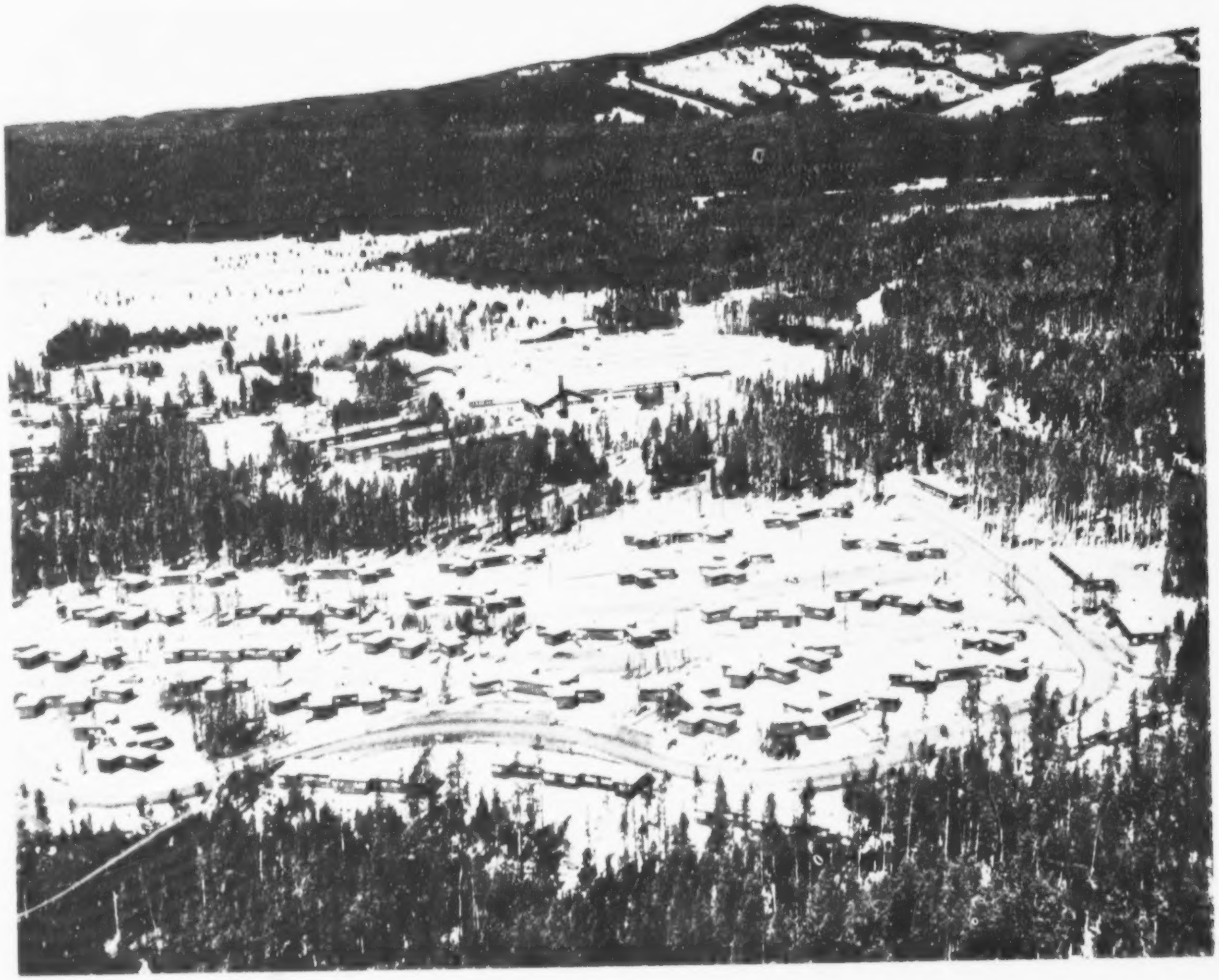


Figure 20.—Tourist accommodations, Canyon Village, Yellowstone National Park.

(*d*) The total of openable window area in each room is equal to at least the minimum as required under item A.2 above, except where there is supplied some other device affording adequate ventilation and approved by the health authority.

D. *Spacing and Location of Buildings* [13]

The minimum spacing between various housing units and any other building regardless of construction type should be as follows:

	Feet
Apartment buildings	40
Bunkhouses	40
Dormitories	40
Duplex residences	30
Multifamily dwellings	40
Quarters	30
Ranger station	30
Unit for seasonal occupancy	40

All buildings in this group should be so located that the side facing the access road is not less than 25 feet back from the inside line of the sidewalk or road curb where no sidewalk occurs. Each building in this group should have one side, other than the one facing the access road, not less than 60 feet from any other building.

Continued evaluation of the building program is necessary to assure that the control of deterioration of buildings and developments as well as the rehabilitation of substandard buildings is being carried out on a planned basis. Inspections of habitable or occupied buildings should be made periodically by the health authority, or upon request of the area supervisor. Inspections should be frequent enough to note and record signs of deterioration which are in need of correction. Follow-up inspections should generally be made when problems are being encountered and for the purpose of checking proposed improvements.

Housing surveys should generally include such items as—

1. Source and adequacy of water supply.
2. Equipment and facilities, especially plumbing, food service, and refuse storage facilities.
3. Heating, lighting, and ventilating.
4. Safe and sanitary maintenance of occupied buildings including accident hazards.

   NOTE: Includes tight construction or screening with hardware cloth to exclude rodents and other small mammals including bats.
5. Space, use, and location requirements, especially in regard to adequacy of sanitary facilities such as toilets, urinals, lavatories, and baths for maximum occupancy.
6. Maximum occupancy—especially space provided for temporary employees.
7. Fire hazards.
8. Sewage disposal.

In areas where flies and mosquitoes are prevalent, adequate provision should be made for effective 16-mesh screening of all habitable or occupied buildings. All screen doors should open outward and be self-closing.

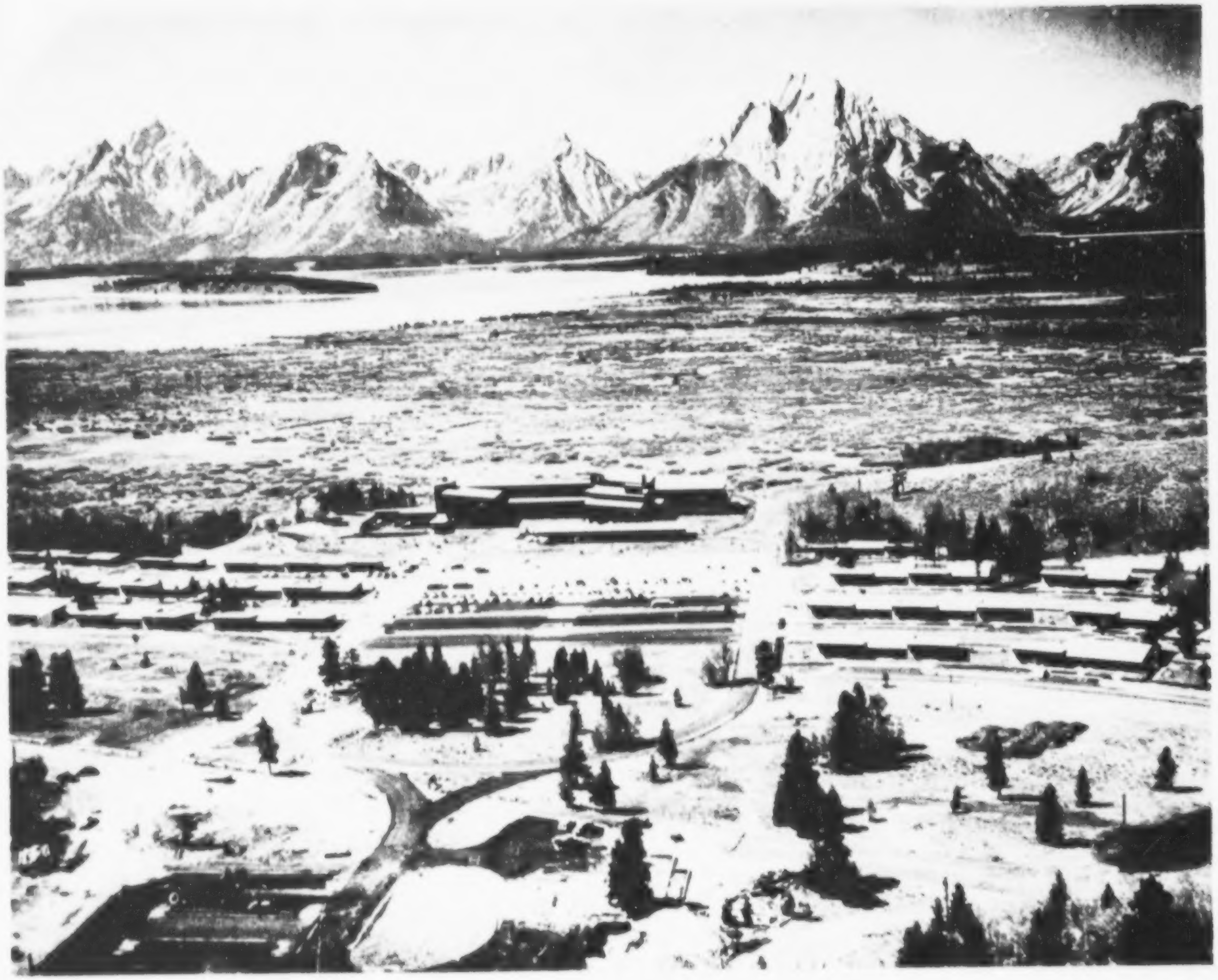


Figure 21.—Housing accommodations. Grand Teton National Park.

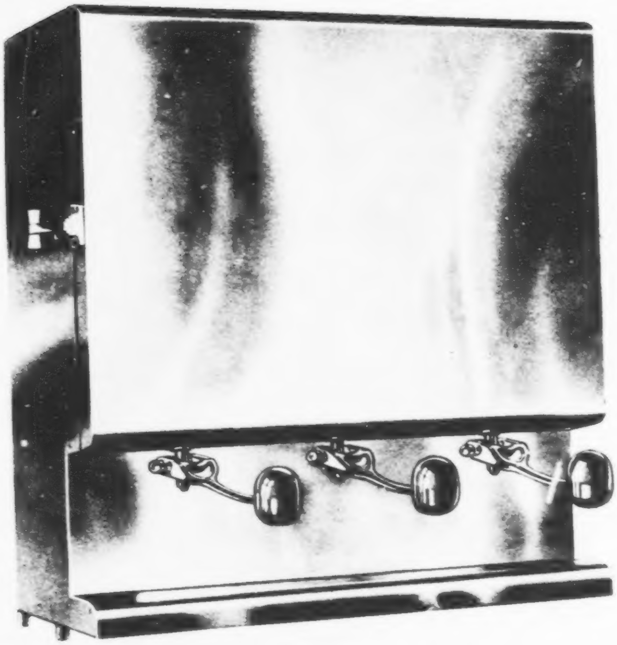


Figure 22.—Typical approved bulk milk dispenser.

Chapter VIII

Milk, Milk Products, and Frozen Desserts

Local and State health authorities have for many years enforced laws and regulations concerning the sanitary quality of milk, milk products, and frozen desserts. These products are unique because their consumption in adequate quantities is essential to the nutritional well-being of the individual; but if not properly safeguarded, they may be instrumental in the transmission of diseases infectious to man.

Thirty-seven States and over 1,900 communities have adopted the Public Health Service "Recommended Milk Ordinance and Code" [15] as the basis of their milk sanitation laws or regulation. Grade A pasteurized milk and milk products produced, processed, and stored using this sanitary standard will, if served properly, minimize or prevent the transmission of milkborne diseases.

SOURCES OF SUPPLY

Lists of Grade A pasteurized milk, milk products, and frozen dessert sources which are approved may be obtained from States and/or local health departments for use in the recreational area. Information on approved sources of fluid milk, milk products, and dry milk products can also be obtained from the *Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers* published periodically by the Public Health Service. The sources listed in this publication are approved for use on interstate carriers and are widely accepted by public health agencies and the milk industry.

Milk and milk products should be kept at or below 45° F., except when being served. Multi-use containers of milk and milk products should not be stored in water in such a manner that the pouring lips of the bottles are submerged. Single-service containers should not be stored in water.

Milk and milk products should be served in the individual containers in which they were received from the distributor or from an approved-type bulk dispenser as illustrated in figure 22. This requirement does not apply to cream that may be served from the original bottle or from a dispenser approved for such service.

All frozen desserts should be maintained in a frozen state between the period of production and dispensing to the consumer to maintain quality and a low bacterial content. Refreezing should not be permitted. Dispensing scoops, spoons, or dippers used in serving frozen desserts should be stored, between uses, in an approved running-water dipper well or in a manner approved by the health authority.

Chapter IX

Food Sanitation

Despite the progress which has been achieved in food protection programs, foodborne illness continues to be a major public health problem. The incidence of such illness can be reduced by the application of the basic principles of food protection. However, to achieve this on a day-to-day basis, better understanding on the part of many food-service employees must be developed, and this in turn will necessitate a maximum of cooperation between public health agencies and the food service industry. The need for even greater attention to this problem in recreation areas is due to seasonal operation of many areas and the widely fluctuating visitor load that must be accommodated by food service facilities provided. Seasonal employees with lack of adequate training in good food-handling practices introduce additional hazards.

OBJECTIVES OF A FOOD SERVICE SANITATION PROGRAM

Both the food and beverage service industry and public health agencies have important roles to play in helping to insure that only safe, wholesome food and drink is offered to the millions who patronize the restaurants, lunch counters, refreshment stands, and other food service establishments in recreational areas. There must be assurance that operations and techniques, including preparation and service to the customer, are such that food is properly protected at all times against contaminants and infective agents. It is essential that hygienic principles be applied to eliminate any conditions or operating methods that might serve as avenues of contamination. Unfortunately food can be easily contaminated and has the potential to support the growth of disease organisms, and may also serve as the vehicle for the transmission of toxic contaminants.

The broad objective of a food sanitation program is the protection of the health of the consumer. Such a program is designed to protect food against contamination and insure the wholesomeness of food and to meet consumer expectations. While esthetic considerations must be recognized as having a place in the overall program, they are less important than the food itself, the personnel employed, and the manner in which processing, storage, and serving are carried out.

A food service sanitation program should be designed to cover all eating and drinking establishments, including fixed establishments and mobile units in recreation areas where food or beverages are served or provided the public, as well as those kitchens, commissaries, and similar food-preparation establishments which are used for the final preparation of food served to the consumer elsewhere. It is not sufficient to apply sanitary standards to food service establishments only. The source of food, food products, and ingredients, as well as transportation methods of all food utilized in recreation areas, should be subjected to control.

CONDUCTING AN EFFECTIVE FOOD SANITATION PROGRAM

Consumer protection through the application of sound public health practices is a basic responsibility of public health agencies. While food sanitation and the protection of the public on a day-to-day basis must be achieved by the food industry, health agencies have a responsibility to see that the job is accomplished. Food sanitation programs should be based on nationally accepted health principles and standards. The vast majority of the health agencies have adopted and use a food sanitation ordinance and code for this purpose. The "Food Service Sanitation Manual,"[16] including A Model Food Service Sanitation Ordinance and Code, 1962 Recommendations of the Public Health Service, is a basic reference in this field. Codes and ordinances are no substitute for well-qualified, well-trained, and competent sanitation personnel. Experience has demonstrated conclusively that impartial, strict enforcement of the ordinance leads to a more satisfactory relationship between the health authorities and industry and creates an atmosphere which produces maximum benefits in terms of food protection.

Although it is not possible to discuss all phases of food sanitation in a publication of this type, some of the more important public health problems which are covered in the *Food Service Sanitation Manual* are presented. Those readers concerned with regulating or operating food service establishments are urged to consult the Manual for more complete coverage of this subject.

FOOD SUPPLIES

All food in food service establishments should be from sources approved or considered satisfactory by the appropriate health authority having jurisdiction, and should be clean, wholesome, free from spoilage, free from adulteration and misbranding, and safe for human consumption. Requirements for milk, milk products, and frozen desserts are covered under chapter VIII of this Guide. All fresh and frozen oysters, clams, and mussels should be from sources approved by the State shellfish authority, or appear on the Public Health Service list of Certified Shellfish Shippers. Meat and meat products and poultry and poultry meat products preferably should be inspected for wholesomeness under an official regulatory program.

FOOD PROTECTION

All food while being stored, prepared, displayed, served, or sold at food service establishments, or during transportation between such establishments, should be protected from contamination. All perishable food should be stored at such temperatures as will protect against spoilage. All potentially hazardous food should be maintained at safe temperatures (45° F. or below, or 140° F. or above), except during necessary periods of preparation and service. Raw fruits and vegetables should be washed before use. Stuffing, poultry, stuffed meats and poultry, and pork and pork products should be thoroughly cooked before being served. Individual portions of food once served to a customer should not be served again. Wrapped food other than potentially hazardous food, which has not been unwrapped and which is wholesome, may be re-served.

Only such poisonous and toxic materials as are required to maintain sanitary conditions and for sanitization purposes should be used or stored in food service establishments. These materials should be identified and should be stored and used only in such manner and under such conditions as will not contaminate food or constitute a hazard to employees or customers.

Ice intended for use for human consumption or to be used in direct contact with food, food equipment, or food utensils should comply with the *Sanitary Standards Relating to the Manufacture, Processing, Storage and Transportion of Ice*—1964 Recommendations of the Public Health Service.[17]

HEALTH AND DISEASE CONTROL

No person while affected with any disease of a communicable form, or while a carrier of such disease, or while afflicted with boils, infected wounds, sores, or an acute respiratory infection, should work in any area of a food service establishment in any capacity in which there is a likelihood of such person contaminating food or food-contact surfaces with pathogenic organisms, or transmitting disease to other individuals; and no person known or suspected of being affected with any disease or condition should be employed in such an area or capacity. If the manager or person in charge of the establishment has reason to suspect that any employee has contacted any disease of a communicable form or has become a carrier of such disease, he should notify the health authority immediately.

CLEANLINESS

All employees should wear clean outer garments, maintain a high degree of personal cleanliness, and conform to hygenic practices while on duty. They should wash their hands thoroughly in an approved hand-washing facility before starting work, and as often as may be necessary to remove soil and contamination. No employee should resume work after visiting the toilet room without first washing his hands.

FOOD EQUIPMENT AND UTENSILS

Construction and Installation of Equipment and Utensils

All equipment and utensils should be so designed and of such materials and workmanship as to be smooth, easily cleanable, durable, and should be in good repair; and the food-contact surfaces of such equipment and utensils should, in addition, be easily accessible for cleaning, nontoxic, corrosion resistant, and relatively nonabsorbent.

Cleaning and Bactericidal Treatment of Utensils and Equipment

Regular, effective cleaning and sanitizing of equipment, utensils, and work surfaces minimize the chances that food will become contaminated during preparation or storage; that food residues will accumulate, decompose, or support the rapid development of food poisoning organisms and toxins; or that disease organisms will be transferred to employees or to customers on unclean eating and drinking utensils contaminated by saliva and unclean hands.

All eating and drinking utensils should be thoroughly cleaned and sanitized after each usage.

All kitchenware and food-contact surfaces of equipment, exclusive of cooking surfaces of equipment, used in the preparation or serving of food or drink, and all food-storage utensils, should be thoroughly cleaned after each use. Cooking surfaces of equipment should be cleaned at least once a day. All utensils and food-contact surfaces of equipment used in the preparation, service, display, or storage of potentially hazardous food should be thoroughly cleaned and sanitized prior to such use. Non-food-contact surfaces of equipment should be cleaned at such intervals as to keep them in a clean and sanitary condition.

After cleaning and until use, all food-contact surfaces of equipment and utensils should be so stored and handled as to be protected from contamination.

All single-service articles should be stored, handled, and dispensed in a sanitary manner, and should be used only once.

Food service establishments which do not have adequate and effective facilities for cleaning and sanitizing utensils should use single-service articles.

The Public Health Service 1962 *Food Service Sanitation Manual*, Publication No. 934, is a basic reference as to procedure which should be used in cleaning and sanitizing equipment and utensils.

Illustrations of various types of sinks and dishwashing machines considered satisfactory are shown in figures 23–25.

Toilet Facilities

Each food service establishment should be provided with adequate, conveniently located toilet facilities for its employees. The doors of all toilet rooms should be self-closing. Where the use of non-water-carriage sewage disposal facilities have been approved by the health authority having jurisdiction, such facilities should be separated from the establishment.

Hand-Washing Facilities

Each food service establishment should be provided with adequate, conveniently located hand-washing facilities for its employees, including a lavatory or lavatories provided with hot and cold or tempered running water, hand-cleansing soap or detergent, and approved sanitary towels or other approved hand-drying devices. In all new establishments, and establishments which are extensively altered, lavatories should also be located within the area where food is prepared.

Garbage and Rubbish Disposal

All garbage and rubbish containing food wastes should, prior to disposal, be kept in leakproof, nonabsorbent containers which should

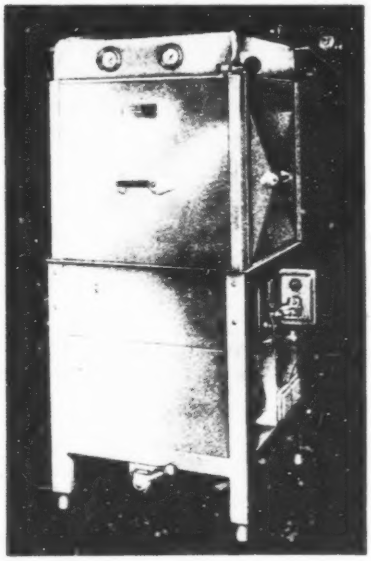


Figure 23.—A mechanical dishwashing machine of the single tank type.

be kept covered with tight-fitting lids when filled or stored, or not in continuous use. Such containers need not be covered when stored in a special verminproofed room or enclosure, or in a food-waste refrigerator. Food-waste grinders, if used, should meet the requirements of the health authority having jurisdiction. The use of food-waste grinders in recreation areas will greatly reduce the difficulties often experienced in the collection, storage, handling, and disposal of wet garbage in refuse disposal sites.

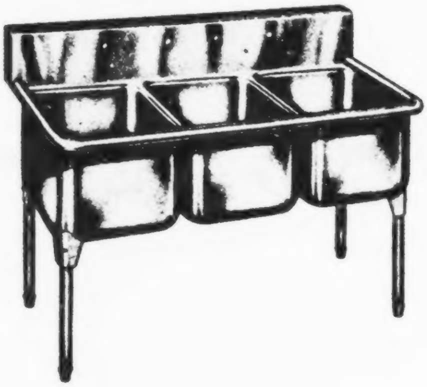


Figure 24.—A three-compartment stainless steel sink.

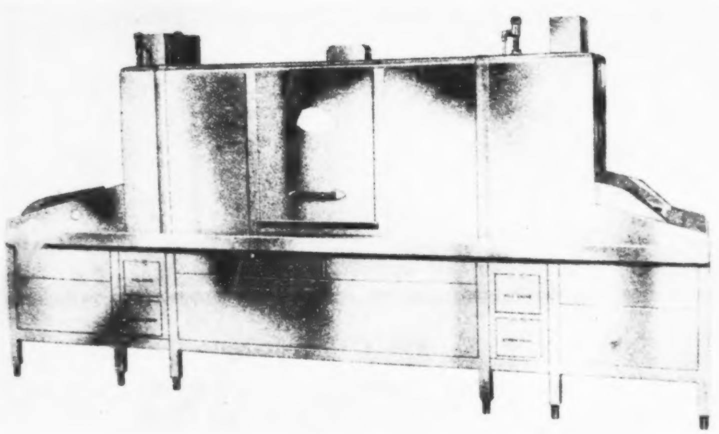


Figure 25.—A mechanical dishwashing machine of the belt type.

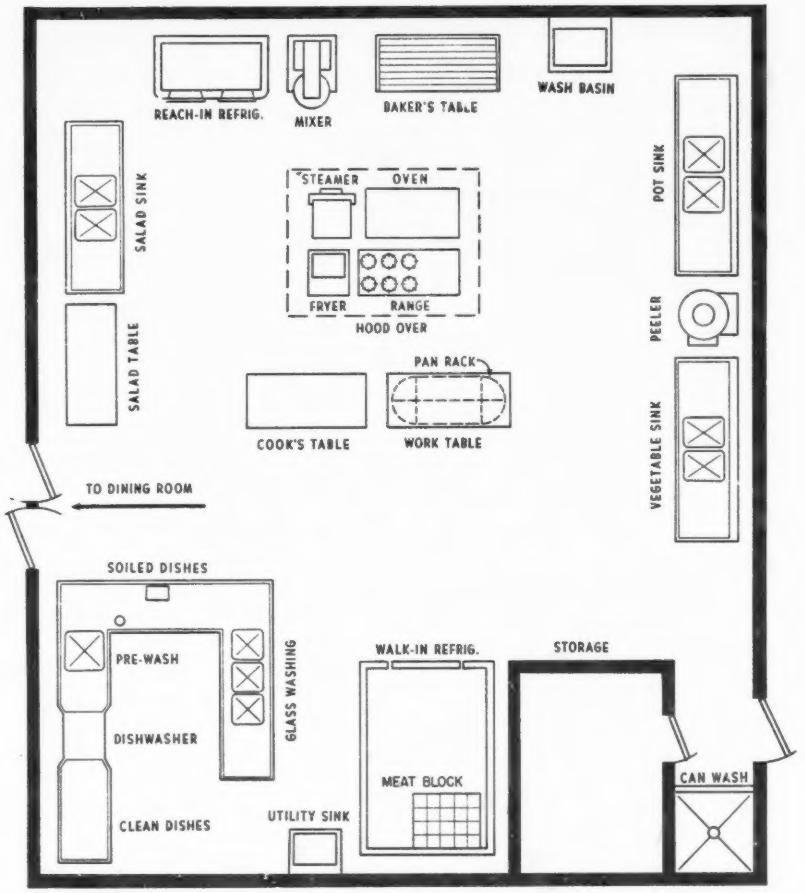

REACH-IN REFRIG.
MIXER
BAKER'S TABLE
WASH BASIN
SALAD SINK
STEAMER
OVEN
POT SINK
FRYER
RANGE
HOOD OVER
PEELER
SALAD TABLE
PAN RACK
COOK'S TABLE
WORK TABLE
VEGETABLE SINK
TO DINING ROOM
SOILED DISHES
PRE-WASH
GLASS WASHING
DISHWASHER
WALK-IN REFRIG.
STORAGE
MEAT BLOCK
CAN WASH
UTILITY SINK
CLEAN DISHES

Figure 26.—Layout of kitchen equipment.

OTHER FACILITIES AND OPERATIONS

All floors, walls, and ceilings in kitchens and other rooms and areas in which food is stored or prepared and in which utensils are washed should be properly constructed and maintained and provided with adequate lighting and ventilation.

A well-laid-out kitchen is easy to work in and clean. The kitchen is usually divided into three separate work areas to keep activities separated. Receiving and storage, preparation and cooking, and dishwashing. In this manner outside traffic is eliminated from food preparation and dishwashing areas, and the flow of traffic between the kitchen and dining room is restricted to the area between the dishwasher and the steam table. A typical layout of kitchen equipment is shown in figure 26.

Inspections of all food establishments and all catering establishments supplying food to recreational areas should be made by the health authority having jurisdiction at regular intervals, preferably at least every 6 months.

All new food service establishments and caterers should be inspected prior to providing service to recreation areas.

Copies of the completed standard inspection forms with copies of the narrative reports covering defects observed should be forwarded to the operator of the establishment or concessionaire for appropriate action. Persons conducting inspections should discuss observations with the personnel responsible for the administration and operation of the area to emphasize the importance of having the defects corrected as soon as possible.

PLAN REVIEW OF FUTURE CONSTRUCTION

When a food service establishment is constructed or extensively remodeled or when an existing structure is converted for use as a food service establishment, properly prepared plans and specifications for such work showing layout, arrangement, and construction materials of work areas, and the location, size, and type of fixed equipment and facilities should be submitted to the health authority having jurisdiction for approval before such work is initiated.

TEMPORARY FOOD SERVICE ESTABLISHMENTS

A temporary food service operation is generally considered to be one that is operated for a period of 2 weeks or less. It differs from a permanent type of operation and usually requires special arrangements to be made for water supply, refuse disposal, refrigeration, lighting, etc.

A temporary or mobile food service establishment should comply with all the provisions of the Public Health Service 1962 Food Service Sanitation Manual.[16]

VENDING MACHINES

Vending machines used to dispense foods and beverages at recreational areas should comply with the requirements of the health authority. "The Vending of Foods and Beverages,"[18] a Sanitation Ordinance and Code Recommended by the Public Health Service, is a basic reference in this field. The health authority should inspect all vending machines in accordance with prescribed regulations. All violations should be called to the attention of officials responsible for their operation.

Chapter X

Refuse Handling

Public health problems are often associated with improper storage, collection, and disposal of refuse in recreational areas. Experience has shown that the application of the basic principles of sanitation to refuse handling results in substantial reductions in fly, rodent, and other insect problems. In addition, there are significant relationships between the incidence of certain diseases in humans and animals and improper refuse disposal. It is also common knowledge that many hazards and nuisances, such as fire, smoke, odors, and unsightliness, are created by poor refuse handling practices. Also, the full appreciation of recreational area values by the public is often diminished by the disorder of accumulated refuse and litter.

REFUSE CHARACTERISTICS AND QUANTITIES

Numerous factors, such as geographic location, season, character of development, types of business, and type and frequency of collection, influence the amounts of refuse collected. The volume of garbage produced per capita is declining with the increased use of frozen and packaged foods and other convenience foods. However, the total pounds of refuse per capita is increasing because of the corresponding increase in household rubbish of such items as paper, cans, and bottles.

The Public Health Service conducted field studies for the National Park Service in 1954, which covered characteristics and quantities of refuse produced in four typical national park installations, including three in the Western States, and one in the East. The results of the studies have been summarized in table 6. These data may be useful in planning refuse disposal programs in similar areas such as State parks, summer camps, and resorts.

STORAGE

In establishing and enforcing rules regarding the preparation and storage of refuse, the following is recommended good practice.

All refuse should be kept in durable, watertight, rust-resistant, nonabsorbent, and easily washable containers that are covered with close-fitting lids and furnished with suitable handles. Lining the containers with a disposable paper or plastic bag aids in maintaining cleanliness and reduces the need for frequent washing of containers. In many areas containers can be replaced by using heavy-duty paper bags with special holders. The containers should be kept covered pending removal, have adequate capacity, and be provided in sufficient

Table 6.—Basic refuse quantity data

		Pounds per capita per day			Cubic feet per capita per day			Percent of garbage and rubbish in refuse	
		Average Minimum	Average Maximum	Median of average	Average Minimum	Average Maximum	Median of average	By weight	By volume
Lodges and hotels	Combined refuse	1. 79	3. 90	3. 5	0. 43	0. 59	0. 43		
	Garbage	1. 89	5. 04	2. 0	. 08	. 13	. 09	60	15
	Rubbish	1. 15	3. 24	1. 3	. 33	. 67	. 37	40	85
Campgrounds	Combined refuse	. 45	1. 60	1. 4	. 07	. 41	. 18		
	Garbage							40	20
	Rubbish							60	80
Picnic areas*	Combined refuse			. 4			. 07		
Park headquarters area (including residences and maintenance areas).	Combined refuse	1. 52	2. 82	2. 0	. 28	. 51	. 40		
	Garbage							53	20
	Rubbish							47	80

NOTE: The above figures for all developments, with the exception of picnic areas, are based on measurements covering volume and weight of a representative sample of refuse in each area. Although ashes were omitted from the samples, the error introduced is relatively small.

*Estimated.

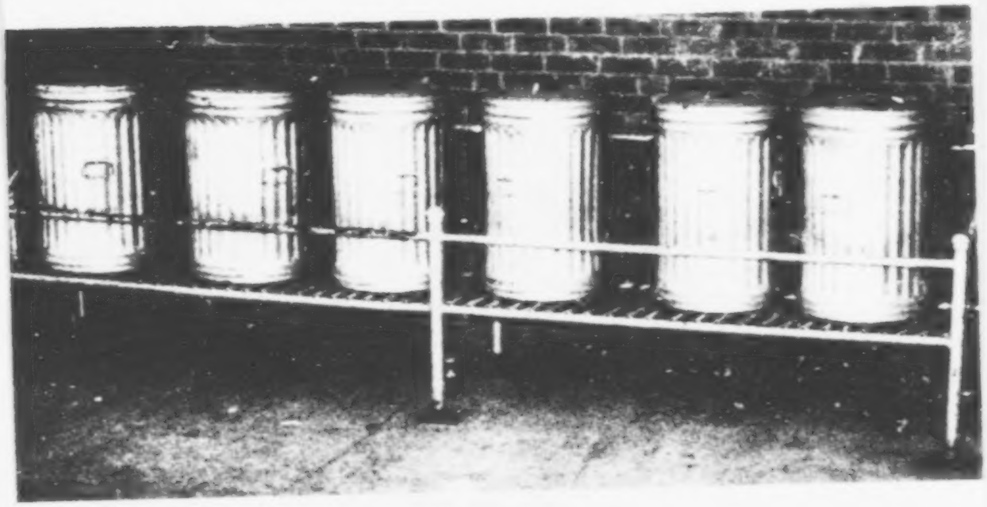


Figure 27.—Refuse container storage rack.

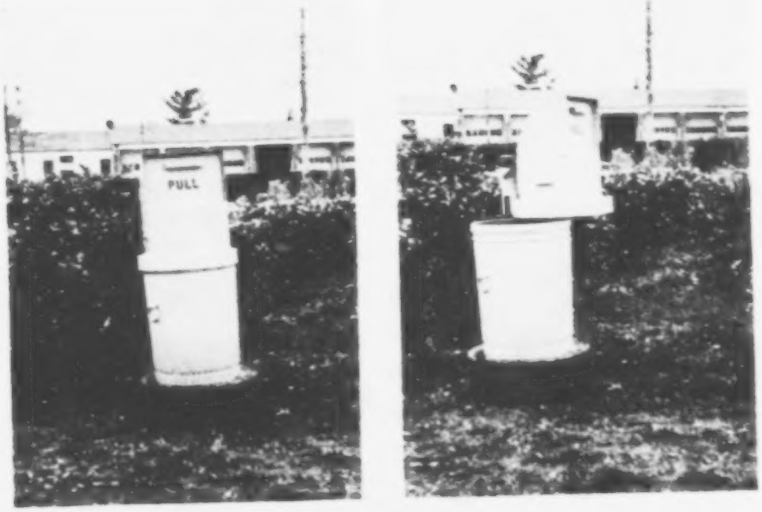


Figure 28.—Bearproof refuse receptacle.

number to hold all refuse that accumulates between collections. The conventional heavy-duty galvanized metal or plastic container with recessed bottom, and a capacity of 20 to 30 gallons, generally meets these above requirements for mixed refuse. Containers of 5- to 12-gallon capacity for garbage are adequate for single-family residences provided for caretakers and employees. Garbage generally requires more preparation for collection than other types of refuse. Draining and then wrapping of garbage in at least three thicknesses of newspaper before it is placed in the containers has several benefits for the householder or small food-handling establishments. Wrapping reduces the production of disagreeable odors either in the containers or during collection and disposal, and it makes garbage less accessible to flies. Rubbish, also, should be stored in covered containers between collections, except in the case of large articles such as large wooden crates, baskets, cardboard boxes, and similar items.

Containers should be placed where they will be convenient to the user and yet be readily accessible to the collection crew. All garbage receptacles at food service establishments, picnic areas, and campgrounds should be kept on concrete slabs or preferably metal or wooden stands located on the premises and easily accessible to the collector. The storage platform should be adequately sloped and drained for the removal of wash water to a suitable disposal point. Washing facilities should be provided to facilitate the cleaning of cans to prevent nuisances and fly breeding. At small developments can-washing facilities are usually provided at or near the point of storage. Where the can exchange system is used, it may be desirable to install central can-washing facilities at the disposal site. A typical container storage rack is illustrated by figure 27.

Special attention should be given to the construction and location of containers in campgrounds, picnic grounds, and cabin areas. Where bears and dogs are common, the containers should be of durable construction, and effectively anchored to prevent them from being knocked over and the refuse scattered. A bearproof refuse receptacle is illustrated in figure 28.

COLLECTION

Refuse collection is an essential part of a well-organized refuse-handling system and has an important bearing on local fly and rodent populations. All refuse should be removed from the premises as frequently as necessary to prevent nuisances and unsightliness. The frequency of collection will vary according to the type of facility being served but, in general, the following periods should prevail:

1. Daily for large food service establishments.
2. Twice weekly for residential areas.
3. Daily to once or twice weekly, as necessary for picnic areas, campgrounds, and parking areas.

The type of collection provided is largely determined by the method of disposal used. Combined collection of mixed refuse is the most practical and economical method, where sanitary landfills or modern incinerators are used. Separate collection of garbage is necessary only if hog feeding is the method of disposal. Garbage from hotels and restaurants is more suitable for this purpose. Basically, collection trucks should have watertight bodies with metal or heavy canvas covers. They should be constructed to facilitate thorough cleaning. Loading heights should be low. Trucks with heights of over 60 inches are generally undesirable because of the greater amount of spillage and additional effort necessary to load them. The following types of collection trucks are generally considered satisfactory for recreational areas:

1. Trucks with dump or fixed-type watertight bodies that can be loaded easily.
2. Can exchange trucks designed for the storage of filled and cleaned containers.
3. Enclosed trucks equipped with power elevators and/or mechanical compactors.

Enclosed trucks, equipped with elevators and/or compactors, should be considered when the volume of refuse is large or the length of haul is long enough to justify the increased cost of the equipment. These units have the following advantages: (1) Refuse is compacted to at least one-half of its original volume, thus reducing the number of trips that must be made to the disposal site; (2) the refuse is completely enclosed and not subject to scattering; and (3) loading heights of as low as 36 inches are possible.

Disposal sites should be located strategically in relation to the areas served to maintain as short a haul as possible. When practical, the collection routes and the sites should be located so that the collection trucks will not have to travel over main highways used by the public.

DISPOSAL

Under the best of circumstances, the problems associated with the disposal of refuse in recreational areas are often difficult. The method to be used for disposal should be governed by the characteristics of the development and determined by careful study and anlysis of the problems involved. There are four methods of disposal presently used in recreational areas which meet public health requirements; they are:

(1) Sanitary landfill;

(2) Incineration;

(3) Garbage grinding with discharge to the sewerage system; and

(4) Feeding cooked garbage to swine. (For complete refuse

disposal, these last two methods must be combined with sanitary landfilling or incineration.)

SANITARY LANDFILL

In a sanitary landfill operation, the refuse is spread, compacted, and then covered with a layer of earth. Garbage, rubbish, ashes, or mixed refuse can be handled easily and compacted into the smallest practical volume by a crawler-type tractor or other suitable equipment. The covering layer of earth is applied daily and compacted to exclude rodents and to prevent the escape of odors and the outbreak of fires. Sanitary landfills are widely used where suitable unwooded land of desirable characteristics is conveniently located, because both initial and operating costs are generally low. In areas where bears are encountered, operations may have to be modified, because bears frequent the disposal areas and attempt to uncover the buried refuse nightly.

Experience indicates that about one-half acre of new land will be needed each year per 5,000 population (based on a 6-foot depth of compacted refuse) for areas operating on a full-time basis. However, this has been found to vary from three-eighths to three-quarters of an acre and even higher depending on local conditions such as methods of operation and type of refuse collected. Available information indicates that a round trip of about 20 miles with noncompactor trucks is the maximum distance of haul before a centrally located incinerator becomes more economical.

There are three methods in general use which utilize sanitary landfill principles: (1) the trench method, (2) the ramp of progressive slope method, and (3) the area method.[19, 20, 21] "Refuse Storage Collection and Disposal in Recreation Areas" was prepared specifically to cover problems which are encountered in recreational areas.

When properly conducted, the trench method provides the most orderly sanitary landfill operation. It is particularly suited to flat or gently rolling ground. Refuse is spread in shallow layers not exceeding a depth of 2 feet of compacted material in trenches with a maximum depth of approximately 8 feet by 1½ to 2½ times the width of the tractor blade and then sealed with at least 6 inches of suitable cover material by the end of each day. Sanitary landfills for small developments can often be provided most economically by excavating a single trench which is adequate in capacity to hold all refuse collected during the tourist season. The trench is either extended the next season or the old trench is sealed at the end of the tourist season and a new trench excavated prior to opening of the development the following year.

In the progressive slope method, cover material is obtained just ahead of the operating face. The refuse is compacted in layers on the face of the slope and covered with 6 inches of earth at the end of each day's operation.

The area method is usually employed at uneven or low sites, where it is impossible or undesirable to obtain cover material from the base of the slope. In low or swampy locations, a moving slope may be built into the area to be filled, working out from a natural bank or a ramp. Refuse is compacted in layers on the face of the slope and covered with earth obtained from nearby areas or it is brought in by truck.

All landfills should be sealed with a final 2-foot layer of compacted cover material.

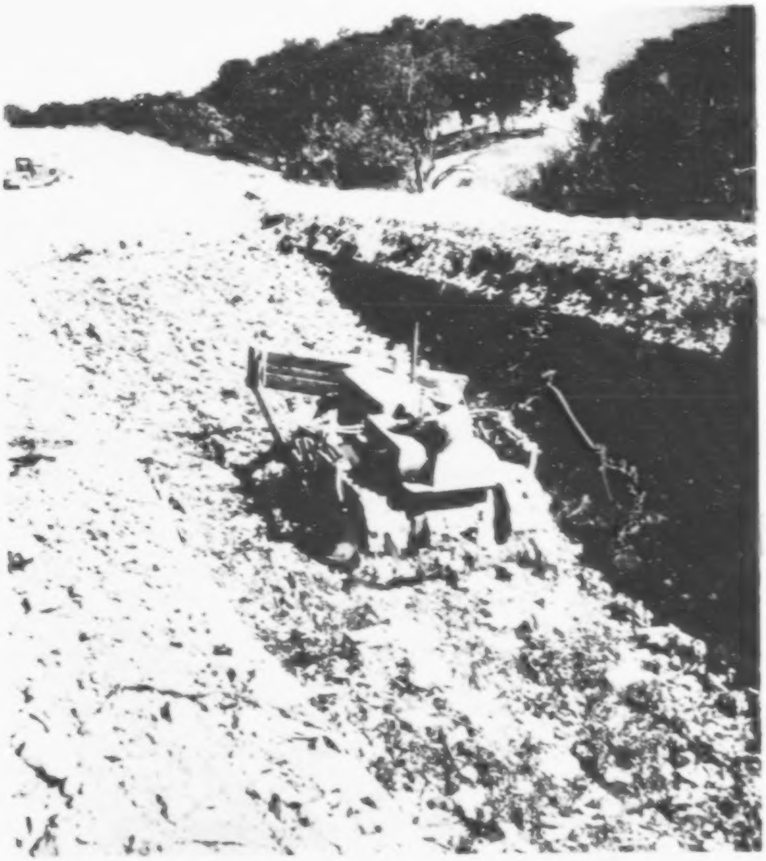
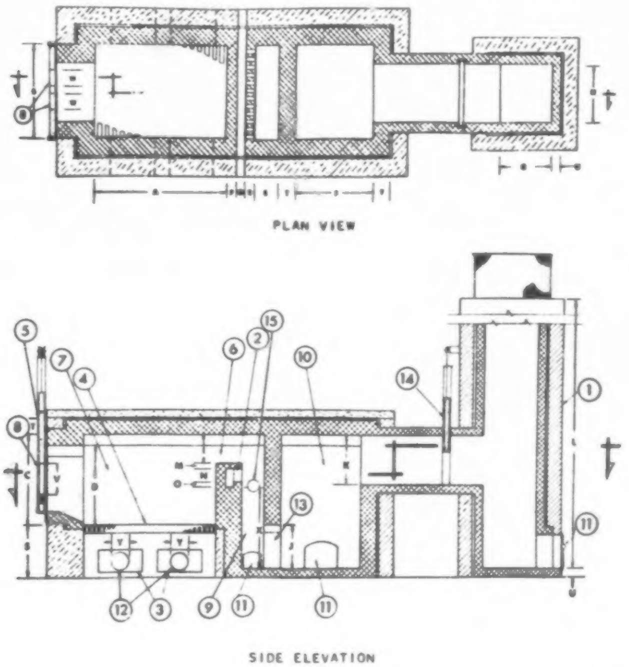


Figure 29.—Sanitary landfill operation.

INCINERATION

Incineration is the process of burning combustible refuse to ash at high temperatures in enclosures designed specifically for the purpose. Well-designed and efficiently operated incinerators provide an excellent means of sanitary refuse disposal. Food for bears and rats, and breeding places for flies are completely eliminated. Since incineration has proved to be an effective means of refuse disposal in many recreational areas, this method of disposal is the most desirable where land suitable for landfilling is unavailable within economical hauling distance and



1. STACK
2. SECONDARY AIR PORTS
3. ASH PIT CLEANOUT DOORS
4. GRATES
5. CHARGING DOOR
6. FLAME PORT
7. IGNITION CHAMBER
8. OVERFIRE AIR PORTS
9. MIXING CHAMBER
10. COMBUSTION CHAMBER
11. CLEANOUT DOORS
12. UNDERFIRE AIR PORTS
13. CURTAIN WALL PORT
14. DAMPER
15. GAS BURNERS

Figure 30.—Multiple-chamber inline incinerators.

where bears are a problem. However, the residue and ashes from incineration, which amount to 5–25 percent by weight, must be disposed of in a landfill.

There are two general types of multiple-chamber incinerators capable of producing the desired results. They are the retort type named for the return flow of gases through the U-arrangement of adjacent chambers, and the in-line type, in which the three chambers follow one after the other in a straight line. A typical in-line incinerator is illustrated by figure 30. Design criteria for this type of unit is presented in "Multiple-Chamber Incinerator Design Standards for Los Angeles County."[22]

GARBAGE GRINDING

Installation of food-waste grinders improves kitchen sanitation by providing means of ready disposal of food wastes, and eliminates the necessity of providing facilities for garbage storage or collection. Their installation, however, does not eliminate the need for landfills or incinerators, inasmuch as garbage is only a small percentage of the total refuse produced. Garbage grinders are not considered practical where existing sewage disposal plants lack capacity to handle the additional organic loading contributed by ground garbage. Their use should be considered, however, when plans for sewage disposal plants are being prepared.

HOG FEEDING

Feeding of garbage to hogs is only acceptable to agricultural and public health authorities when the garbage has been cooked at boiling temperatures for at least 30 minutes prior to feeding. Cooking is necessary to prevent the spread of hogborne diseases, such as vesicular exanthema, that are transmissible to hogs; and trichinosis which is transmissible to both man and animals. Permits to collect garbage from recreational areas for hog feeding should be issued only when the feeding operation is located a safe distance beyond fire area's boundaries. This will insure problems related to hog feeding such as production of odors and residues, fly breeding, and drainage pollution will not be created within the recreational area. The feeding operation must be approved by the authority which has jurisdiction.

MODIFIED REFUSE DISPOSAL METHODS

At the smaller recreational areas where it is not practical or economically feasible to dispose of refuse by means of a sanitary landfill, incineration, or garbage grinding, it may be advisable to consider modification of these procedures.

Modification of sanitary landfill techniques is usually necessary when the volume of refuse is inadequate to justify keeping a crawler-type tractor at the disposal area continuously for the daily compaction and covering of refuse. Modifications of disposal methods, which have been used with some success in areas where necessary, are:

1. Separate collection of garbage and rubbish, followed by—

a. Disposal of the garbage by periodic burial (by hand if necessary) in previously prepared trenches or by cooking and feeding to hogs; and

b. Disposal of rubbish by burning in suitable enclosures. The ashes and noncombustibles will then be incorporated in the landfill.

2. Depositing of mixed refuse in previously prepared trenches, followed by compaction and covering with a layer of earth two or three times weekly. This procedure usually reduces fly production and odor nuisances. Since windblown material becomes a problem under these conditions, the area should be fenced to keep this material from being scattered over wide areas.

3. Depositing of mixed refuse in previously prepared trenches, followed by daily burning of the combustible material and biweekly burial of the remains. This procedure can be followed only where burning of combustible material in open trenches will not create health hazards or create fire hazards.

LITTER

Littering or the scattering of refuse in campgrounds, picinc areas, etc., and areas adjacent to highways, parkways, parking areas, and scenic overlooks has become a problem of major concern to authorities responsible for the operation and maintenance of recreational areas. This practice detracts from the appearance of these areas, creates potential health hazards, and results in higher operating costs. In some areas it has been necessary to employ additional personnel primarily for the pickup of paper, bottles, cans, and waste food particles which are scattered by the thoughtless visitor, thus increasing operating costs. This material usually attracts rodents and flies which create a potential health hazard to visitors.

Control over littering in recreational areas, is, under the best of circumstances, often difficult. However, the best control can be obtained by initiating a carefully planned program of operation. This usually involves the adoption of rules and regulations governing the scattering of refuse, proper enforcement and prosecution of violators, education of visitors to observe rules and regulations, provision of a sufficient number of refuse containers in strategic locations that are serviced frequently, and supplemented by the cleanup and disposal of any scattered material. An excellent resource of information on litter control can be obtained from Keep America Beautiful, Inc., a national public service organization for the prevention of litter.

Chapter XI

Swimming Pools and Outdoor Bathing Places

Swimming and associated activities such as sunbathing and wading is one of the fastest growing recreational interests in the Nation. With the increase in pool construction, which currently is at a rate of about 70,000 pools annually, swimming will remain the most popular of the outdoor activities, with the possible exception of travel and sightseeing.

Public health authorities have been concerned with sanitation and safety problems involving swimming and bathing for many years. While the problem of accidents and drowings are the most dramatic statistics relating to swimming, the communicable disease aspects must be given proper attention.

GENERAL PRINCIPLES OF BATHING PLACE SANITATION

In the control of swimming pool and bathing place sanitation, certain broad principles should apply to all classes of public bathing places.

1. No person having a communicable disease should be employed or work at a public bathing place. All patrons or swimmers suspected of having an infectious disease should be excluded.
2. Appropriate facilities should be provided for the safety of bathers as may be required by the health authority having jurisdiction. This should include lifesaving equipment, safety devices, lifebuoys, lifehooks, first-aid kits, together with adequate staff during swimming periods who are competent in lifesaving and artificial resuscitation.
3. At public bathing beaches on natural waters the same sanitary standards should apply to bathhouses, dressing rooms, toilet facilities, and to the handling and care of bathing apparel as would be required at artificial swimming pools.
4. Sanitary drinking fountains with a supply of safe potable water should be installed at all bathing places. The common use of towels, drinking cups, combs, hairbrushes, or other toilet articles should be strictly prohibited.

SWIMMING POOLS

All swimming pools should be designed and constructed in accordance with the requirements of the health authority having jurisdiction or in the absence thereof, in accordance with the standards outlined

Figure 31.—Outdoor swimming pool.

in the "Suggested Ordinance and Regulations Covering Public Swimming Pools."[23] Plans and specifications covering proposed swimming pools and those to be substantially altered or reconstructed should be submitted to the health authority for review and approval before construction is initiated.

Water Supply

The water supply serving the pool and all plumbing fixtures including drinking fountains, lavatories, and showers should meet the requirements of the health authority for potable water.

All portions of the water distribution system serving the pool and auxiliary facilities should be protected against backflow. Water introduced into the pool, either directly or to the recirculation system, should be supplied through an airgap. When such connections are not possible, the supply should be protected by a suitable backflow preventor installed on the discharge side of the last control valve to the fixture, device, or appurtenance.

Sewer

The sewer system should be adequate to serve the facility, including bathhouse, locker room, and related accommodations.

There should be no direct physical connection between the sewer system and any drain from the swimming pool or recirculation system. Any swimming pool or gutter drain or overflow from the recirculation system when discharged to the sewer system, storm drain, or other approved natural drainage course should connect through a suitable airgap so as to preclude possibility of backup of sewage or waste into the swimming pool piping system.

The sanitary sewer serving the swimming pool and auxiliary facilities should discharge to the public sewer system whenever possible. Where no such sewer is available, the connection should be made to other suitable treatment facilities in accordance with requirements of the health authority having jurisdiction.

User Loading

For the purposes of computing user loading, those portions of the swimming pool 5 feet or less in depth should be designated as "nonswimmer" areas. Portions of the pool over 5 feet in depth should be designated as the "swimming" area.

In order to compute swimmer and bather capacity, swimming pool areas should be determined as follows:

1. Ten square feet of pool water surface area should be provided for each nonswimmer expected at time of maximum load.
2. Twenty-four square feet should be provided for each swimmer expected at time of maximum load.
3. Three hundred square feet of pool water surface area should

be reserved around each diving board or diving platform and this area should not be included in computing the area of the swimming section.

The health authority may make additional allowance for bathers in cases of swimming pools with extensive deck areas used by patrons for lounging or sunbathing. These allowances can be based on studies of actual swimming pool use in areas within the jurisdiction of the health authority.

Dressing Rooms

Bathhouses to be used simultaneously by both sexes should be divided into two parts separated by a tight partition, individually designated for men or for women. The entrances and exists should be screened to break the line of sight.

Floors of bathhouses should be of smooth finished material with nonslip surface, impervious to moisture and sloped to a drain. Junctions between walls and floors should be coved.

Toilets and Showers

Toilet and shower facilities should be provided on the basis of the plumbing fixture schedule outlined in table 4, chapter VI. The layout of the bathhouse should be such that bathers on leaving the dressing room pass the toilets and showers en route to the pool.

Operation Control

1. Swimming pools should be operated under the close supervision of a well-trained operator. A lifeguard should be on duty during all bathing hours. When no lifeguard is provided, a warning sign should be placed in plain view indicating that no lifeguard is on duty and the pool should not be used by children without an adult in attendance.

2. Swimming pools when in use should be continuously disinfected by a chemical which imparts an easily measured free available residual effect. When chlorine is used, a free chlorine residual of at least 0.4 ppm should be maintained throughout the pool whenever it is open or in use. If other halogens are used, residuals of equivalent disinfecting strength should be maintained. A testing kit for measuring the concentration of the disinfectant, accurate within 0.1 ppm, should be provided at each swimming pool.

3. The health authority having jurisdiction may accept other disinfecting materials or methods when they have been adequately demonstrated to provide a satisfactory residual effect which is easily measured and to otherwise be equally as effective under conditions of use as the chlorine concentration required therein, and not be dangerous to public health, create objectionable physiological effects, or impart toxic properties to the water.

4. Swimming pool water should be maintained in an alkaline condition as indicated by a pH of not less than 7.2 and not over 8.2. A pH testing kit accurate to the nearest 0.2 pH unit should be provided at each swimming pool. The alkalinity of the water should be at least 50 ppm, as measured by the methyl-orange test.

5. The water should have sufficient clarity at all times so that a black disk, 6 inches in diameter, is readily visible when placed on a white field at the deepest point of the pool. The pool should be closed immediately if this requirement cannot be met.

6. The pumps, filter, disinfectant and chemical feeders, and related appurtenances should be kept in operation at all times the swimming pool is in use and for such additional periods as needed to keep the pool water clear and of a satisfactory bacterial quality. Continuous operation of the recirculating system should be maintained in swimming pools having a capacity of 20,000 gallons or more during seasons of regular use.

7. Chemicals used in controlling the quality of water should be demonstrated as imparting no toxic properties to the water. Such chemicals as may be used for algae control should be approved for use by the health authority having jurisdiction.

8. Proper operating records, which may include the following as required by the health authority, shall be kept showing daily:

- (*a*) Bather loads—total;
- (*b*) Peak bather load;
- (*c*) Volume fresh water added;
- (*d*) Operating periods of recirculation pumps and filters and corresponding rate of flow meter readings;
- (*e*) Amounts of chemicals used;
- (*f*) Disinfectant residuals;
- (*g*) pH readings;
- (*h*) Maintenance (and malfunctioning) of equipment.

9. Visible dirt on the bottom of the swimming pool should be removed every 24 hours or more frequently as required. Visible scum or floating matter on the swimming pool surface should be removed within 24 hours by flushing, skimming, or other effective means.

Bacterial Quality of Swimming Pool Waters

Samples for bacteriological examination should be collected in specially treated bottles obtained from the health authority only when the pool is in use and preferably during periods of heaviest daytime bathing loads. It is desirable to collect one or more samples weekly from swimming pools.

Not more than 15 percent of the samples covering any considerable period of time should either (*a*) contain more than 200 bacteria per milliliter, as determined by the standard (35° C) agar plate count, or

(*b*) show positive test (confirmed test) for coliform organisms in any of the five 10-milliliter portions of a sample or more than 1.0 coliform organisms per 50 milliliter when the membrane filter test is used.

WADING POOLS

By definition, a wading pool should normally be a small pool for nonswimming children only, used for wading, and should have a maximum depth at the deepest point not greater than 24 inches.

Because of the high degree of pollution likely to be present, a wading pool should have a maximum turnover cycle of 2 hours. The supply to the wading pool should consist of filtered and adequately disinfected water. Water from the circulating outlets from the wading pool may be wasted or may be returned to the circulation system of the large pool at the suction side of the pump for refiltration. There should also be provided a waste outlet at the deepest point of the wading pool, by means of which it can be completely emptied to waste.

In general, standards of sanitation in circulation, surface skimming, and all other details should be equal or superior to those for swimming pools. Wading pools, by the nature of their usage, are likely to become polluted and a public hazard. Where installed, they should be operated very carefully to minimize the danger to public health. They should be drained, scrubbed out, and disinfected once daily. It is considered very desirable to install a spray pool in lieu of a wading pool, where no water stands at any time but is drained away freely as it sprays over the area.

OUTDOOR BATHING PLACES

Under this heading are considered bathing places along small streams, rivers, lakes, and tidal waters.

Sources of Pollution

In an artificial swimming pool whose water is derived from a supply of unquestioned quality and maintained by constant recirculation and treatment, it may be assumed that the occurrence or presence of organisms of the coliform-aerogenes group in the bacteriological examination of a sample is due to human fecal pollution. In outdoor bathing places, however, the presence of such bacteria may be due to the runoff from cultivated fields and soil animal life on the watershed which is usually considered to be less harmful contamination. Insasmuch as routine bacteriological examinations do not differentiate between sources of harmless and harmful contamination as may be caused by

Figure 32.—Outdoor bathing place.

←

sewage from boats, dwellings, and other establishments; or public sewerage systems; refuse dumping; and bathers themselves or soil or animal pollution, it is necessary to consider the presence of all coliform organisms as indicative of harmful contamination.

Bacteriological Standards for Outdoor Bathing Places

In evaluating the quality of water in outdoor bathing places, the following aspects should be taken into consideration:

1. The results of chemical analyses of the water;
2. The results of bacteriological examinations of the water; and
3. Information obtained by a sanitary survey of sources of pollution, consideration of flow currents, etc.

Analyses of samples of bathing waters intelligently interpreted are of great value, but full consideration should be given to conditions under which samples are collected and conditions which may exist at other times. The replenishment of bathing water by streamflow, by tidal action, and by wind and temperature currents; the contamination introduced by bathers themselves; and the intermittency of various sources of sewage pollution are all of importance.

There is still a wide divergence of opinion as to standards of acceptable bacteriological quality for outdoor bathing places, but the following information may be useful in utilizing bacteriological examination results as a guide in evaluating the acceptability of outdoor bathing places:[24]

> Some areas of the country are reported to be able to meet bacterial standards for natural surface waters with maximum limits of coliform indexes of not more than 240 to 500 per 100 ml. Such excellent quality, is of course, greatly to be desired. However, experience indicates that other sections of the country, especially those located in more densely populated areas and among cultivated lands cannot maintain such conditions.
>
> Waters showing a concentration of most probable numbers of coliform organisms of less than approximately 1,000 per 100 ml. are considered in most such areas to be fairly acceptable for bathing unless the sanitary survey discloses immediate dangers of human sewage pollution. However, it must be admitted that bathing beaches where the content of coliform organisms runs as high as 2,400 per 100 ml. on the basis of most probable numbers, or sometimes even higher, have been used without reported evidence of illness, and this limit of 2,400 per 100 ml. is still employed as a criterion of acceptability in some states.

Bathing in streams or ponds subject to gross animal pollution should not be allowed because of the possible danger of animalborne virus diseases.

The above information should be used for classification of outdoor bathing areas. Proper sanitary facilities for outdoor bathing places such as dressing rooms, showers, toilets, lavatory accommodations, etc., should meet the same requirements as for indoor swimming pools.

Chapter XII

Travel Trailer Parking

More families every year are finding that the travel trailer is the solution to their vacationing problems. Whether the reasons for travel trailer use be economy or convenience, the ability to visit most any part of the country and take along many of the comforts of home seems appealing to many travelers.

The great increase in the number of travel trailers on the highways during the vacationing months is quite evident to the motoring public and reflects the increasing amount of leisure time and extra spending power being enjoyed by more people each year. It also points out the need to keep pace by the development of adequate travel trailer parking areas and related facilities each year which meet accepted standards of health and safety.

THE TRAVEL TRAILER

The size of, and accommodations contained in, travel trailers vary widely; however, a commonly accepted definition is as follows:

> A vehicular portable structure built on a chassis, designed as a temporary dwelling for travel, recreational, and vacation use, permanently identified "Travel Trailer" by the manufacturer on the trailer and, when factory equipped for the road, of body width not exceeding eight feet and of any length providing its gross weight does not exceed 4,500 pounds, or of any weight provided its body length does not exceed 29 feet.

Thus, in contrast to the larger mobile home, a travel trailer is a smaller unit, used primarily for temporary recreational purposes such as weekend camping or vacation trips and is pulled by the family car.

Many of the smaller travel trailers contain only sleeping, lounging, dining, and simple cooking facilities, while the larger ones contain more complete living accommodations, including bathroom facilities, full kitchen equipment, self-contained hot and cold water supply, and often a holding tank for sewage. All have their own LP (low pressure) gas supply in tanks usually located on the **A**-frame at the front of the trailer. All may have gas (or possibly oil) space heaters. The larger ones are always so equipped. They usually have a 12-volt light and appliance system. The electrical equipment is often convertible to 110-volt use, when available, to save battery drain.

For the purpose of determining the needs of travel trailer parking areas to provide toilet, bathing, and kitchen or other liquid waste disposal facilities, travel trailers are classified into two categories, *Self-Contained* and *Non-Self-Contained*. Those classified as *Self-Contained* have: sleeping accommodations; kitchen sink and other food preparation equipment; a water-flushed toilet; lavatory and shower; and a sewage-holding tank for retaining liquid wastes. These travel trailers can be used without need of any service hookups to water and sewer utilities. Under these circumstances, the availability of a "Sanitary Station," as described below, to properly dispose of the liquid wastes and the holding tank capacity will govern the length of trailer use. Those classified as *Non-Self-Contained* have sleeping and usually kitchen facilities only and are dependent on a service building provided in the parking area for at least toilet and lavatory facilities. Current information obtained from the travel trailer industry indicates that approximately 50 percent of the travel trailers being used are *Non-Self-Contained* and 50 percent are *Self-Contained*.

Nearly all travel trailers have hose bib-type inlet couplings for hooking up to water supply systems. Sewage-holding tanks are provided with valved pipe outlets below the trailer for connection to either individual sewer outlets at the parking space or for disposal at sanitary stations.

SANITARY STATION

The development of the travel trailer with a holding tank for sewage wastes has created a public health problem—the indiscriminate dumping of sewage along highways and in recreation areas. A major step has been taken to alleviate this problem with the development of a low-cost travel trailer sanitary station. These stations are being installed in many recreation areas and several major oil companies are installing these units adjacent to their gas stations to provide a free service for the convenience of travel trailer owners. A typical sanitary station is shown in figure 33. The station utilizes a foot-operated seal cover providing sanitary closure of the sewer pipe inlet when not in use. One end of a drain hose is connected to the holding tank of the travel trailer with the free end placed securely in the drain opening while the cover is opened and the tank is allowed to empty.

A concrete apron surrounds the sewage inlet with a slope gradient to permit periodic washdown of the immediate adjacent area. The water hose for this washdown is a modification of an upright gasoline station air hose tower. It is spring loaded at its midsection to return it to vertical position after use. The nozzle end clears the ground by 18 inches and a vacuum breaker is also required to prevent backsiphonage into the water supply. The water tower may be replaced by other watering facilities for flushing and cleaning purposes that are approved by the local health authority having jurisdiction.

TRAVEL TRAILER PARKING AREAS

There are two basic types of travel trailer parking areas: overnight and destination. The overnight travel trailer parking area is usually located along or near a main highway, where travel trailerists stop overnight on the way to some farther destination. The destination type of travel trailer parking area is usually located at or near a scenic or historical area, or near camping, fishing, hunting, boating, swimming, skiing, or other outdoor recreational activities where the duration of stay may extend to several days or weeks. Some parking areas may be developed for both overnight and destination needs.

The travel trailerist going to or from his destination vacation spot might not be too concerned with esthetics or scenery, but he is quite concerned with convenience of location to the highway, cleanliness and orderliness of the area, provision for easy parking, convenience of eating establishments, and in the cleanliness and adequacy of the service building facilities. The desire of the vacationing travel trailer family for a clean, dignified location in a community where he will feel secure and accepted for the duration of his stop should be considered by prospective park owners and community officials.

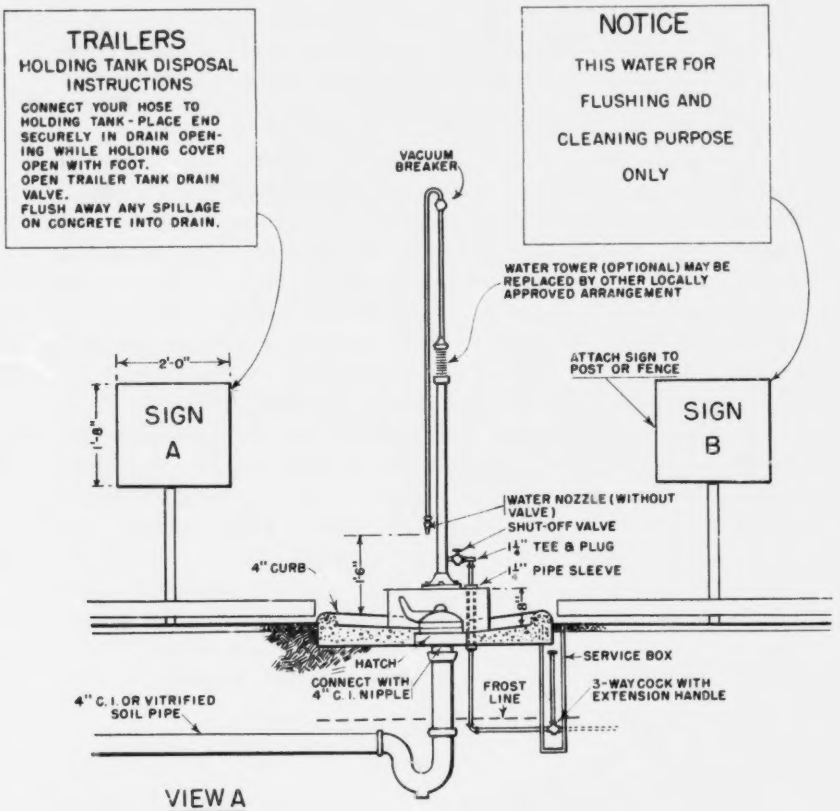
FACILITIES FOR TRAVEL TRAILER PARKING AREAS

Site Selection

To be most acceptable and efficient, sites for travel trailer parking areas should not encroach on any scenic, scientific, or historic values in an area. The availability of adequate water supply and of satisfactory means of sewage disposal is also a basic consideration in selecting a suitable site. Sites should be well drained, preferably gently sloping and free of obstructions. An important consideration for overnight use is accessibility to main roadways and tourist services such as restaurants and shopping areas.

Roads and Parking Areas

Roads where practical should be one way to help preserve natural features and paved to control dust. Curves should be adequate to accommodate the travel trailer and towing vehicle. Curves on interior circulation roads should have a minimum inside radius of 25 feet and on exterior circulation roads a radius of 35 feet. Grades should be as minimum as possible, because some trailers are a heavy load for the towing vehicle. Maximum grades of minus 6 percent and plus 4 percent are recommended.



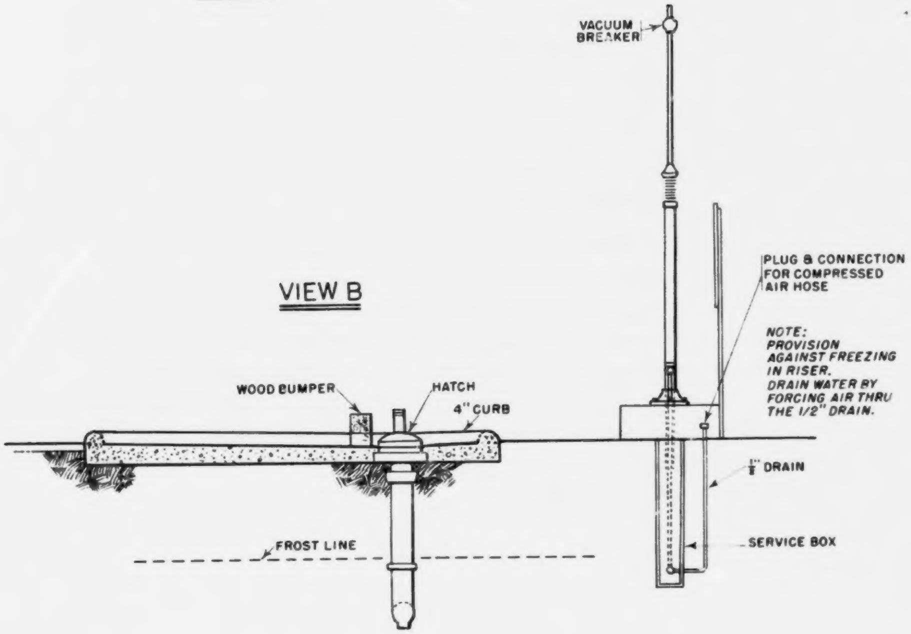
TRAILERS
HOLDING TANK DISPOSAL
INSTRUCTIONS

CONNECT YOUR HOSE TO HOLDING TANK - PLACE END SECURELY IN DRAIN OPENING WHILE HOLDING COVER OPEN WITH FOOT.
OPEN TRAILER TANK DRAIN VALVE.
FLUSH AWAY ANY SPILLAGE ON CONCRETE INTO DRAIN.

NOTICE
THIS WATER FOR
FLUSHING AND
CLEANING PURPOSE
ONLY

VACUUM BREAKER
WATER TOWER (OPTIONAL) MAY BE REPLACED BY OTHER LOCALLY APPROVED ARRANGEMENT
2'-0"
1'-8"
SIGN A
ATTACH SIGN TO POST OR FENCE
SIGN B
WATER NOZZLE (WITHOUT VALVE)
SHUT-OFF VALVE
1¼" TEE & PLUG
1¼" PIPE SLEEVE
4" CURB
1'-6"
8"
HATCH
SERVICE BOX
CONNECT WITH 4" C. I. NIPPLE
FROST LINE
3-WAY COCK WITH EXTENSION HANDLE
4" C. I. OR VITRIFIED SOIL PIPE

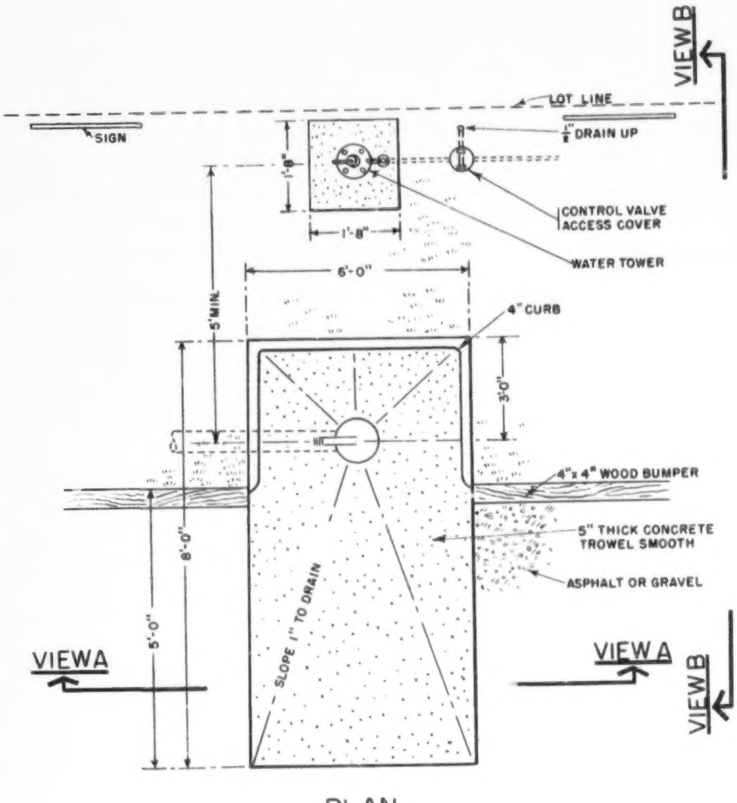
VIEW A



VIEW B

VACUUM BREAKER
PLUG & CONNECTION FOR COMPRESSED AIR HOSE
WOOD BUMPER
HATCH
4" CURB
½" DRAIN
FROST LINE
SERVICE BOX

NOTE:
PROVISION AGAINST FREEZING IN RISER.
DRAIN WATER BY FORCING AIR THRU THE 1/2" DRAIN.


VIEW B
LOT LINE
SIGN
1/8" DRAIN UP
1'-8"
CONTROL VALVE
ACCESS COVER
1'-8"
WATER TOWER
6'-0"
5' MIN.
4" CURB
3'-0"
4"x4" WOOD BUMPER
5" THICK CONCRETE
TROWEL SMOOTH
8'-0"
ASPHALT OR GRAVEL
5'-0"
SLOPE 1" TO DRAIN
VIEW A
VIEW A
VIEW B

PLAN

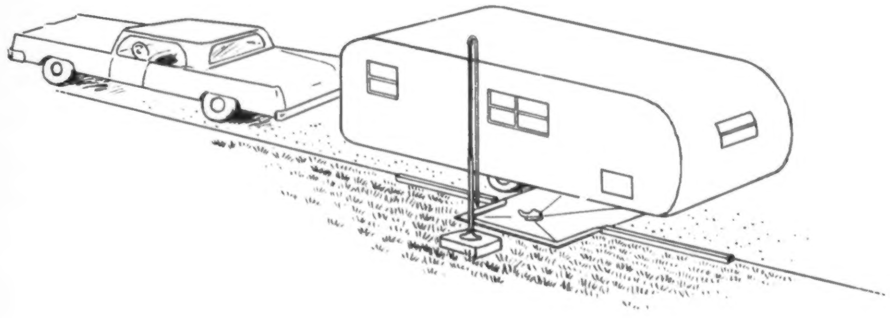


Figure 33.—Typical sanitary station.

Drivethrough parking spaces which permit occupancy without having to unhitch the trailer from the towing vehicle are preferred to back-in-type parking spaces particularly for overnight parking. Back-in-type parking is most suitable for destination needs. Parking spaces for the travel trailers should be level in cross section and on a grade for drainage. Maximum grades of minus 1.5 percent, and plus 3 percent should be used for the drivethrough spaces. A typical layout of a travel trailer parking area is shown in figure 35.

Space Limitations

Spaces that vary in width are desirable and will probably result where natural features are to be preserved. Spaces of a size that will place trailers 20 feet apart are desirable, though a 15-foot separation is minimum according to the National Fire Protection Association. Usually, it has been found practical to limit the number of individual travel trailer parking spaces to 25 per acre.

Water and Sewer Facilities

A sanitary station as described above should be provided in destination travel trailer parking areas for the disposal of liquid wastes from travel trailers equipped with holding tanks. It is also desirable to have sanitary stations provided in overnight travel trailer parking areas, but the need for this type of facility is not as critical as for destination areas. Individual water and sewer risers in each space are desirable, especially for *Self-Contained* travel trailer spaces.

The need for more sophisticated water and sewage service is often a matter of local determination based on factors such as duration of stay in the park, amount of convenience desired by the travel trailer owner and park operator, and the volume of business handled. The most satisfactory arrangement from the public health viewpoint is the provision of individual water and sewer connection facilities at each space; however, from an economic viewpoint, the ability to install these especially for overnight parking is often limited or impractical. Where a water supply connection is provided, it should consist of a riser terminating at least 4 inches above the ground surface with a ¾-inch threaded valve outlet provided with a cap or screw plug. The riser pipe should be designed so that it can be operated during freezing weather and drained if necessary. This may require the use of electrical heater tapes or specially constructed risers. A typical water supply connection is shown in figure 36.

A hydrant and hose for filling water tanks may be provided as a convenience to travel trailer guests, but it should be located at a point separate from that used for the sanitary station.

An individual sewer connection, where provided, should consist of a 4-inch riser with at least a 3-inch sewer connection extending at least

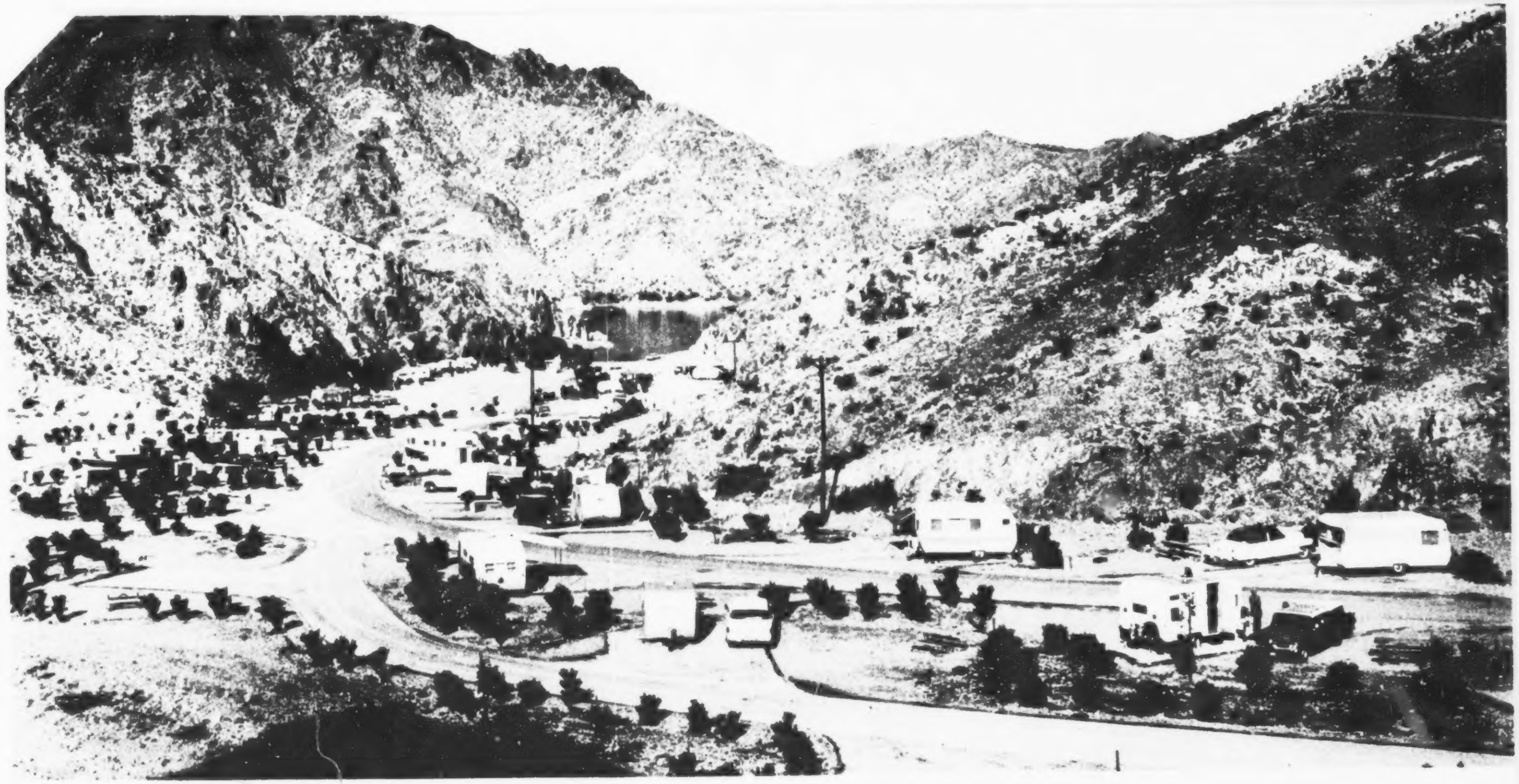
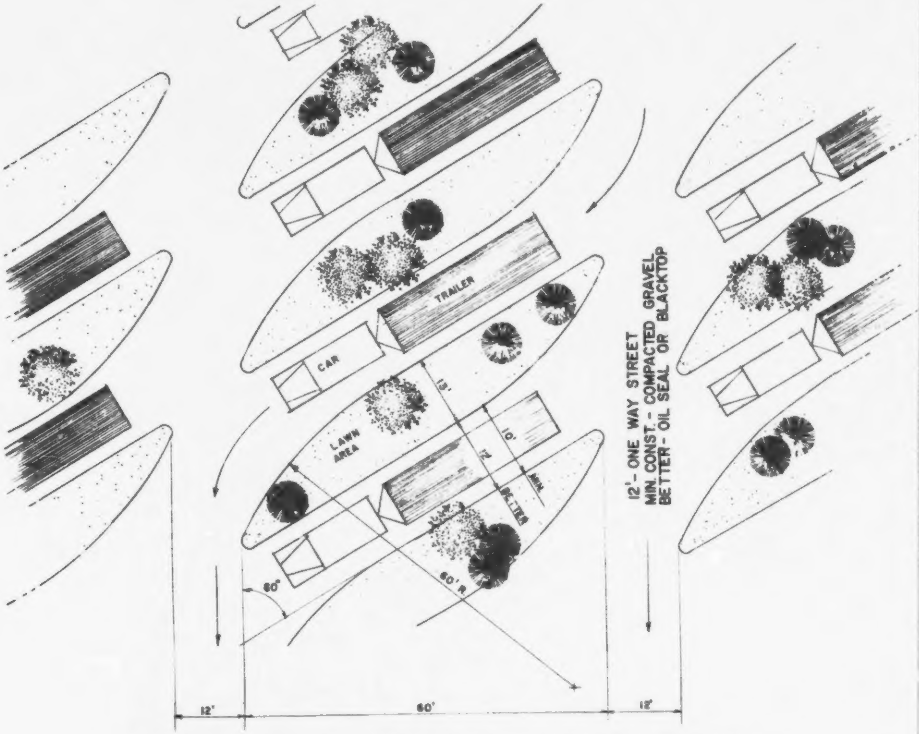


Figure 34.—Willow Beach trailer parking area on Lake Mohre, Lake Mead National Recreational Area.



TYPICAL TRANSIENT (OVERNIGHT) TRAVEL TRAILER PARK

INDIVIDUAL SPACE ALLOTMENT
AVERAGE SPACE - 20'x 60' = 1200 SQ. FT.

RECOMMENDED FACILITIES

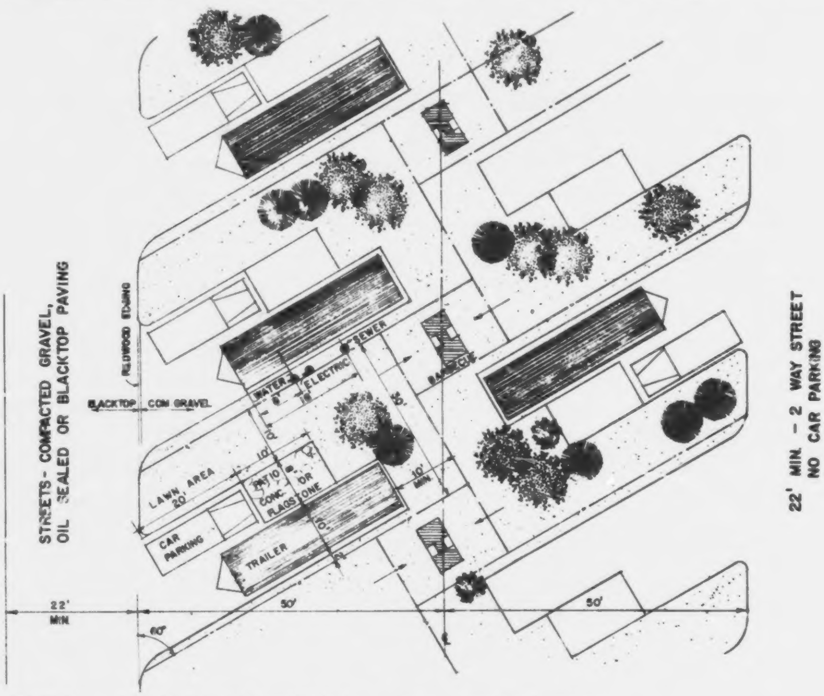
FOR OVERNIGHT PARKS

1. ABSOLUTE MINIMUM: CENTRAL TRAVEL TRAILER SANITARY & WATER STATIONS, & TOILETS.
2. FAIR: INDIVIDUAL ELECTRICAL OUTLETS, CENTRAL TRAVEL TRAILER SANITARY & WATER STATIONS, AND TOILETS.
3. GOOD: INDIVIDUAL ELECTRICAL OUTLETS, CENTRAL TRAVEL TRAILER SANITARY & WATER STATIONS, TOILETS AND SHOWERS
4. BETTER: INDIVIDUAL ELECTRICAL & WATER OUTLETS, SEVERAL INDIVIDUAL SEWER CONNECTIONS, ONE OR MORE CENTRAL TRAVEL TRAILER SANITARY STATION, TOILETS, SHOWERS AND COIN-OPERATED LAUNDRY.
5. BEST: INDIVIDUAL ELECTRICAL, WATER, & SEWER CONNECTIONS, TOILETS & SHOWERS, COIN-OPERATED LAUNDRY AND PICNIC TABLES.

FOR DESTINATION PARKS

1. ABSOLUTE MINIMUM: BACK-IN PARKING, INDIVIDUAL ELECTRICAL OUTLETS, CENTRAL TRAVEL TRAILER SANITARY & WATER STATIONS, AND TOILETS & SHOWERS.
2. FAIR: BACK-IN PARKING, INDIVIDUAL ELECTRICAL & WATER CONNECTIONS, CENTRAL TRAVEL TRAILER SANITARY STATION, TOILETS & SHOWERS.
3. GOOD: DRIVE-THROUGH PARKING, INDIVIDUAL ELECTRICAL & WATER CONNECTIONS, CENTRAL TRAVEL TRAILER SANITARY STATION, TOILETS, SHOWERS, COIN-OPERATED LAUNDRY, AND PICNIC TABLES.
4. BETTER: DRIVE-THROUGH PARKING, INDIVIDUAL ELECTRICAL & WATER CONNECTIONS, CENTRAL TRAVEL TRAILER SANITARY STATION, TOILETS, SHOWERS, COIN-OPERATED LAUNDRY, PICNIC TABLES, AND GROCERY.
5. BEST: DRIVE-THROUGH PARKING, INDIVIDUAL ELECTRICAL, WATER, & SEWER CONNECTIONS, TOILETS, SHOWERS, COIN-OPERATED LAUNDRY, PICNIC TABLES, GROCERY. ALSO BARBECUE, BOTTLED GAS, TRAVEL TRAILER PARTS FOR SALE, PLUS BAIT & OTHER FISHING AND SPORT ACCESSORIES. RECREATION BUILDING AND SWIMMING POOL MAY BE ON A "PAY AS YOU GO" BASIS.

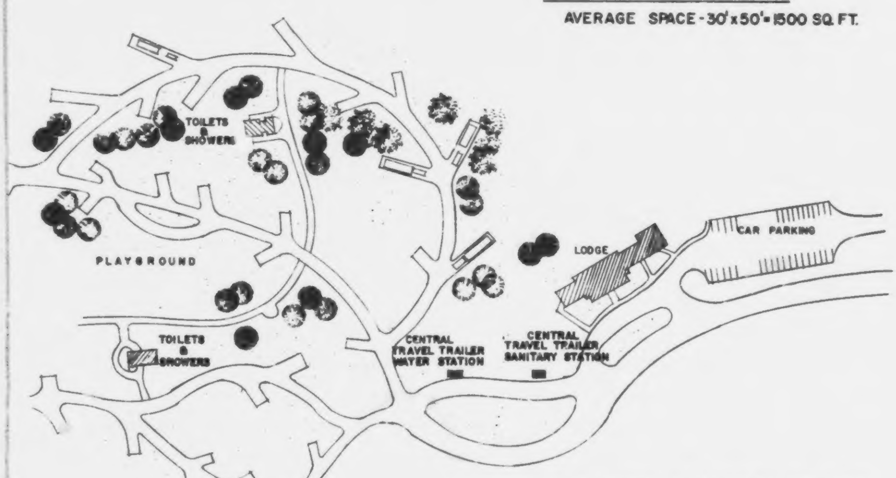
Figure 35.—Typical travel trailer parking arrangements.


STREETS - COMPACTED GRAVEL,
OIL SEALED OR BLACKTOP PAVING
REDWOOD SIDING
BLACKTOP
COM GRAVEL
WATER
ELECTRIC
SEWER
BARBECUE
LAWN AREA
20'
10'
PATIO CONC. OR FLAGSTONE
CAR PARKING
TRAILER
10' MIN.
22' MIN.
50'
50'
60°
22' MIN. - 2 WAY STREET
NO CAR PARKING

TYPICAL RESORT(DESTINATION) TRAVEL TRAILER PARK

INDIVIDUAL SPACE ALLOTMENT

AVERAGE SPACE-30'x50'=1500 SQ.FT.


TOILETS & SHOWERS
PLAYGROUND
TOILETS & SHOWERS
CENTRAL TRAVEL TRAILER WATER STATION
CENTRAL TRAVEL TRAILER SANITARY STATION
LODGE
CAR PARKING

A TYPICAL MOUNTAIN RESORT
TRAVEL TRAILER PARK

Courtesy of Mobile Homes Manufacturers Association Park Division

4 inches above the ground surface and provided with an easily removable watertight cap or screw plug. The connection should be protected against "wheel damage" by a concrete collar, at least 3 inches thick and extending 12 inches from the connection in all directions, or other protective measures. A typical sewer connection is shown in figure 37.

Liquid wastes from sinks should not be discharged onto or allowed to accumulate on the ground surface. Where sewer outlets at the travel trailer site are not provided, seepage pits on such sites may be provided for the disposal of sink wastes where a direct connection is made between the sink drain and the seepage pit. No other liquid wastes should be discharged into the seepage pit. Approval for this type of installation should be obtained from the health authority having jurisdiction.

Refuse Disposal

Adequate facilities for the storage, collection, and disposal of refuse should be provided for the travel trailer parking area. Refuse should be stored in durable, flytight, watertight, and rodentproof containers which should be maintained in a clean condition and kept in good repair. Permanent locations should be selected for refuse containers, and satisfactory racks or holders should be provided which will minimize spillage and container deterioration. A rack station should be located near the circulation roads and a maximum of 150 feet from any travel trailer space.

Service Building

A central service building containing the necessary toilet and other plumbing fixtures specified on page 101 should be provided in a travel trailer parking area which provides parking spaces for *Non-Self-Contained* travel trailers. Service buildings should be conveniently located for the number of parking spaces within a radius of approximately 300 feet.

Where a travel trailer parking area is designed for and exclusively limited to use by *Self-Contained* travel trailers, a service building containing toilets, urinals, lavatories, and showers is not required.

Installation of a service building requires a safe and adequate water supply and an approved sewage disposal system as described in chapters IV, V, and VI of this Guide.

Number of parking sites [a]	Toilets		Urinals	Lavatories		Showers		Other fixtures [b]
	Men	Women	Men	Men	Women	Men	Women	
1-15	1	1	1	1	1	1	1	1 slop sink.[c]
16-30	1	2	1	2	2	1	1	
31-45	2	2	1	3	3	1	1	
46-60	2	3	2	3	3	2	2	
61-80	3	4	2	4	4	2	2	
81-100	3	4	2	4	4	3	3	

For parking areas having more than 100 travel trailer sites, there should be provided 1 additional toilet and lavatory for each sex, for each additional 30 travel trailer sites; 1 additional shower for each sex for each additional 40 travel trailer sites; and 1 additional men's urinal for each additional 100 travel trailer sites

[a] Parking spaces for *Non-Self-Contained* travel trailers.

[b] Additional fixtures including laundry trays, clothes-washing machine (1 for every 30 sites), and an icemaking machine may be desirable.

[c] A slop sink for disposal of liquid wastes unless a sanitary station is conveniently accessible for this purpose.

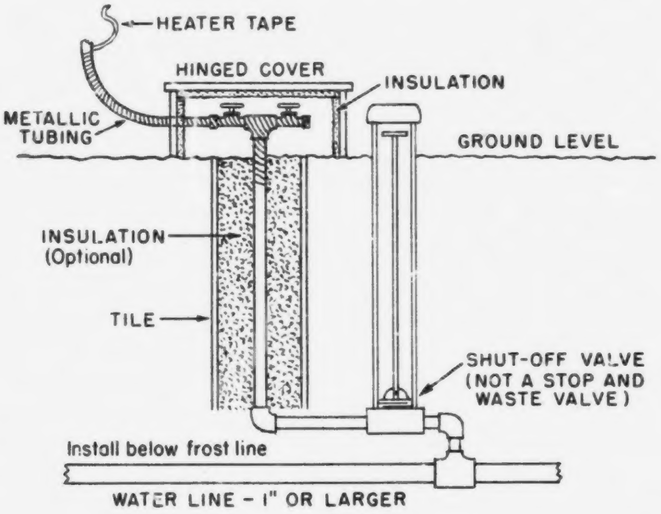

HEATER TAPE
HINGED COVER
INSULATION
METALLIC TUBING
GROUND LEVEL
INSULATION (Optional)
TILE
SHUT-OFF VALVE (NOT A STOP AND WASTE VALVE)
Install below frost line
WATER LINE - 1" OR LARGER

Figure 36.—Typical water supply connection showing a method of winter protection.

Electrical Service

The electrical service to the travel trailer site should preferably be provided by means of a direct-burial, underground cable, connected to a receptacle mounted on a pedestal. The receptacle should be 125-volt, 30-ampere, and a weatherproof type or mounted in a weatherproof box.

All electrical wiring should be in compliance with applicable State and local codes, or where none exists, with the National Electrical Code.

Plan Review

Detailed plans and specifications should be developed for proposed travel trailer parking areas and forwarded to the health authority having jurisdiction for review and approval. The plan should include a general layout showing facilities to be provided in relation to adjoining developments and detailed plans showing: (1) The area and dimensions of the site; (2) the number, location, and dimensions of all travel trailer spaces; (3) the location and width of roads and walks; (4) the location of the service building, sanitary station, or other proposed structures; (5) the location of water and sewer lines; and (6) the location of storm drains and catch basins. When it is necessary to provide private water supply and sewage disposal facilities, their location should be shown.

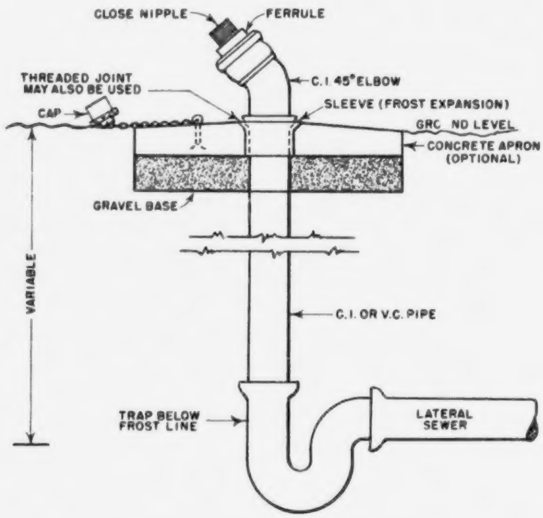

CLOSE NIPPLE
FERRULE
THREADED JOINT MAY ALSO BE USED
C.I. 45° ELBOW
CAP
SLEEVE (FROST EXPANSION)
GROUND LEVEL
CONCRETE APRON (OPTIONAL)
GRAVEL BASE
VARIABLE
C.I. OR V.C. PIPE
TRAP BELOW FROST LINE
LATERAL SEWER

Figure 37.—Typical sewer connection.

Chapter XIII

Boating

The outdoor boating industry reported in 1962 that there are more than 8 million pleasure boats being used for recreation in U.S. waters and the trend is increasing upward. More and more of these boats are being equipped with a galley and toilet facility. Therefore, body wastes, galley wastes, and other debris are being discharged into our watercourses to threaten or damage recreational values as swimming, fishing, and other aquatic sports. The dredging of boat basins, construction of small craft harbors, marinas by the hundreds, boat launching ramps and docking floats are but a few of the type projects being constructed or planned for recreation areas. Such new developments which attract and serve boating enthusiasts may create water pollution and related health problems of concern to public health and recreational agencies. For this reason it is most important that the planning of such developments consider the environmental health aspects involved.

MARINAS

Marinas are being constructed in many recreation areas to provide a center of activity where boats can be berthed, launched, repaired, fueled, and provisions obtained.

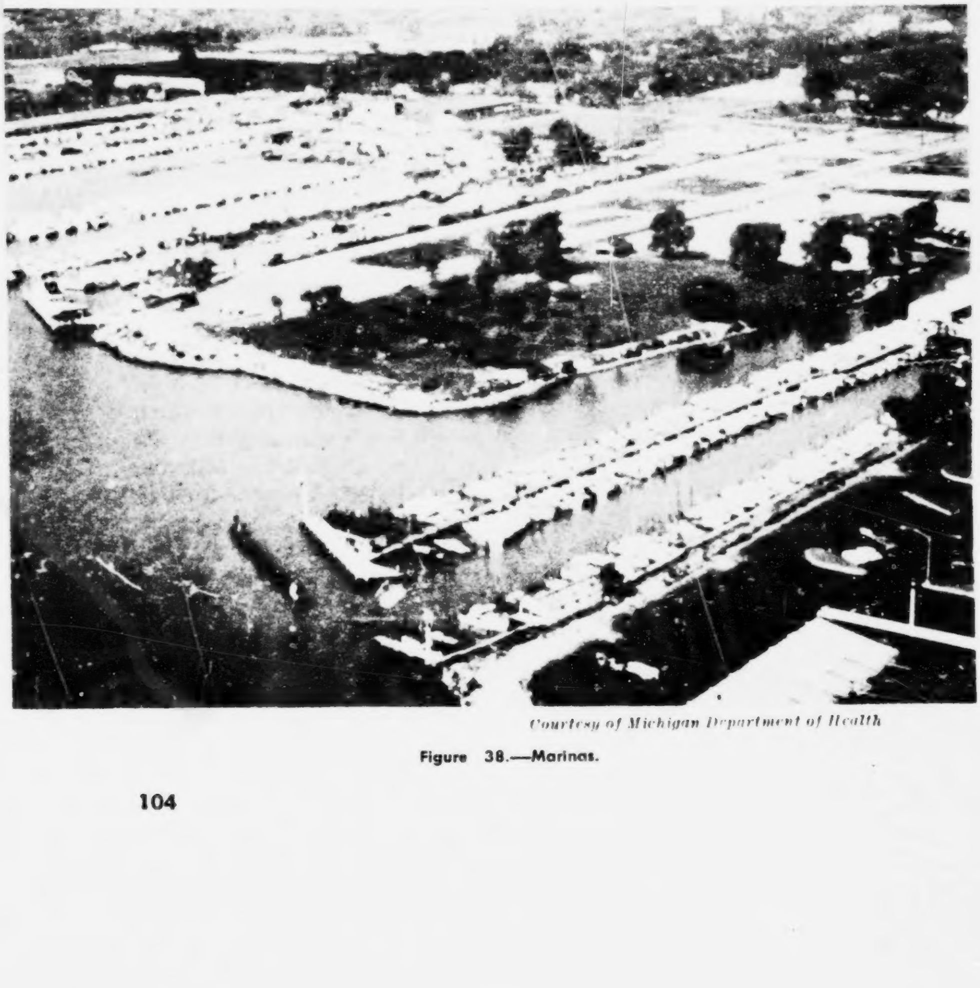
Adequate facilities for collection and disposal of domestic sewage, waste oils and fuel, and solid wastes as garbage and refuse should be included in the planning and design of a marina. The collection and disposal of each of these wastes, because of their varying characteristics, must be handled separately. Some communities require the marina operator to lock and seal the heads on all boats not equipped with suitable treatment such as a chlorinator device upon berthing. Several States have adopted requirements concerning sewage discharge from boats. The eventuality of this requirement becoming more widespread should be anticipated. A permanent comfort station with sanitary facilities for both sexes centrally and conveniently located near piers should be a prerequisite in the design of a marina.

The use of a municipal system for sewage disposal is most desirable when the marina is located within a community having a sewerage system. Connection to an existing system will usually prove most satisfactory and most economical even when it is necessary to run a trunkline a long distance to effect a connection. Where this cannot be accomplished, other methods of sewage disposal as discussed in this Guide should be provided.

The proper collection and disposal of garbage, trash, and other debris is important not only from the standpoint of appearance but for insect and rodent control. A few simple precautions taken by the marina operator can eliminate potential public health problems. Several heavy-duty receptacles with self-closing covers should be provided on the piers for the interim disposal of refuse. Final disposal can be accomplished on shore at designated sites.

Boat-Launching Areas

The construction of docking facilities and launching ramps aid in eliminating the indiscriminate launching of boats from adjacent highways. In an area where boating is a popular pastime, one boat-launching facility for trailered boats has been provided for each 160 surface-acres of boating water.[25] This facility includes a paved ramp with a minimum width of about 20 feet and a grade of about 10 percent which extends from above the high-water level to a sufficient distance below the low-water level to permit boat launching at minimum water levels. Parking space is provided adjacent to the ramp for the parking of automobiles and boat trailers.



Courtesy of Michigan Department of Health

Figure 38.—Marinas.

Boat-Docking Facilities

When buildings with modern sanitary facilities are located on floats adjacent to floating boat docking facilities, arrangements should be made to dispose of all wastes in and approved manner. Liquid wastes from these facilities should be collected in water-tight retention tanks, from where they are pumped to sewage disposal facilities located a safe distance above high-water levels. Refuse from these developments should also be transported above high-water levels for proper disposal. The storage and dispensing of gasoline from floating facilities should be carried out in a manner to keep spillage at a minimum.

Boating Requirements

1. When boats provided with marine toilets are permitted to operate in receational watercourses where it is desired to institute pollution control measures, the following requirements should be enforced:

(*a*) No marine toilet on any watercraft should be constructed and operated as to discharge any inadequately treated sewage into the watercourses directly or indirectly as required by the health authority or local water pollution control agency having jurisdiction. All sewage passing into or through the marine toilet should pass solely through the treatment device.

(*b*) When the use of marine toilets is not permitted, no watercraft equipped with a marine toilet should be used unless the sanitary facilities are removed, sealed, or made to drain into a retention tank for subsequent disposal at designated disposal sites on shore.

2. All refuse, including garbage, cans, bottles, waste paper, etc., should be stored in a durable container with tight-fitting cover for subsequent disposal on shore at designated disposal sites.

3. The operation of pleasure boats within a reasonable distance of waterworks intakes, bathing areas, and dams should generally be restricted by means of warning signs on buoys or floats because of the potential health and accident hazards involved.

4. Boats launched in receational area waters should be equipped to meet minimum safety requirements for pleasure boats as recommended by the U.S. Coast Guard.

5. Regulations should be esablished to control health and accident hazards associated with boating activities in receational areas. Whenever overly hazardous conditions develop on receational waters due to tides, winds, high elevation, ice, or other emergency conditions, the waters should be closed to boating, temporarily restricted, or limited to use of certain types of boats.

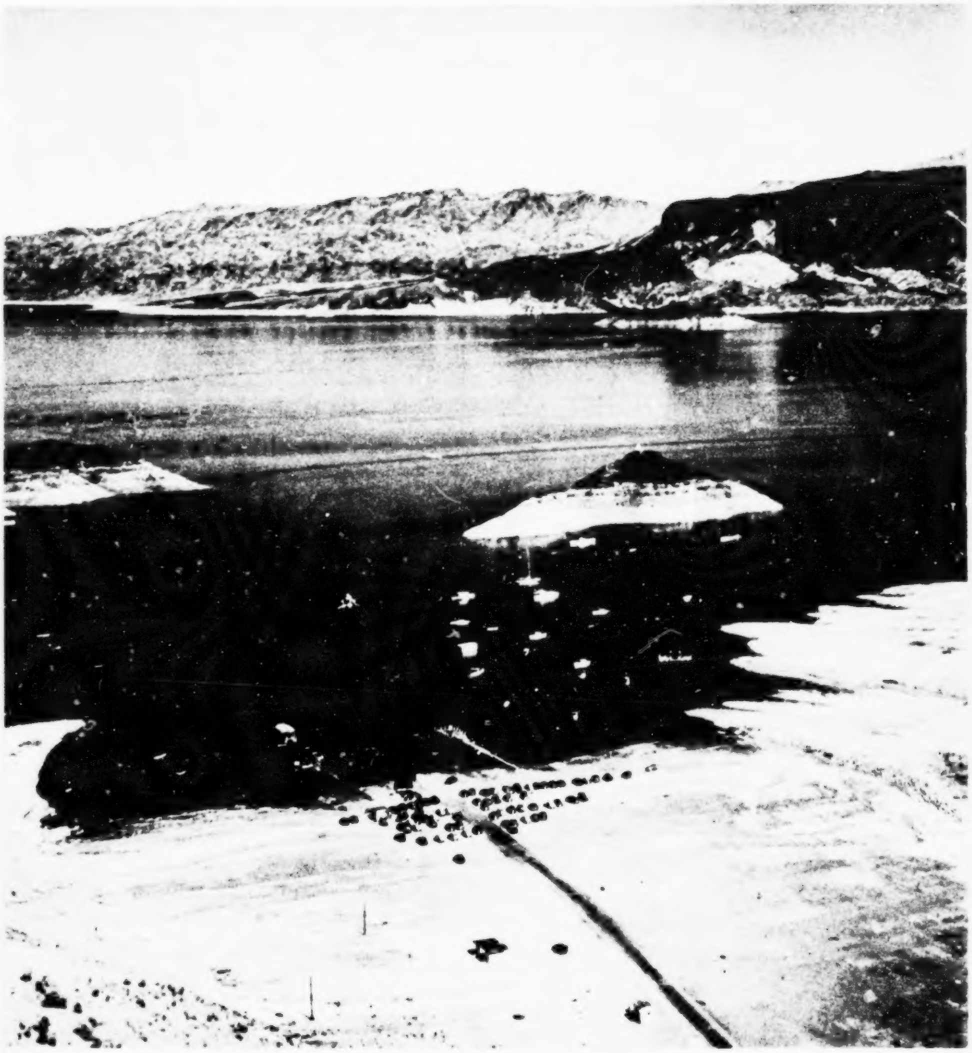


Figure 39.—Boat launching facilities, Lake Mead National Recreational Area.

Chapter XIV

Fish-Cleaning Facilities

Fishing is an activity many visitors enjoy while visiting recreational areas, especially where natural reproduction and stocking of local waters is accomplished. Where fishing is productive, consideration should be given to the installation of fish-cleaning facilities near boat docking and launching areas. These facilities are essential to control nuisances, odor, and pollution from the indiscriminate cleaning of fish and the disposal of these wastes into lakes, reservoirs, and along shorelines

In planning these units, consideration should be given to providing the following facilities:

1. Fish-cleaning facilities should preferably be located in a screened enclosure, or building provided with an impervious floor which slopes to a trapped floor drain.
2. Where electricity is available, the building should be wired to provide proper lighting and for the operation of equipment.
3. Tables provided with impervious, nonabsorbent surfaces which slope to centrally located drains should be provided for fish cleaning.
4. Water under pressure should be provided to facilitate the cleaning of fish and for general cleanup of floors and tables.

If the table drains are to be connected to the sewerage system or a retention tank, heavy-duty garbage grinding units should be installed in each drain for the purpose of pulverizing the solids, so that this material can pass through the sewers or be pumped from the retention tank for subsequent disposal. Water outlets, preferably with flexible extensions, should be located at a convenient height above the tables to wash the solids to the drains. A desirable arrangement includes a spring-operated foot control switch, which activates a solenoid valve to turn on the water and grinding unit simultaneously. Release of the foot-operated switch automatically turns off the water and grinding unit.

When power is unavailable, wastes from the cleaning tables may be drained directly to retention tanks through untrapped drains and pumped out periodically for disposal by burial or other approved means. This material should not be discharged into a sewerage system, because the solids, especially fish heads, may be responsible for obstructing the sewers. Scrupulous cleanliness of facilities should be maintained to eliminate offensive odors and the attraction of flies. When it is necessary to remove the solids from the retention tank by pumping, the pump acquired for this purpose should be capable of removing solids such as fish heads.

Chapter XV

Insect and Rodent Control

Several groups of arthropods and rodents may create serious public health and nuisance problems at recreational areas. These include species that are vectors of human disease organisms or which serve as reservoirs of these organisms or otherwise interfere with man's health, welfare, and comfort. A number of aquatic insects may be encountered at recreational areas located along the shores of impoundments. Mosquitoes are undoubtedly the most important of these insects, since several species serve as vectors of encephalitis and malaria, and others create public health problems because of their vicious biting habits.[26] Other groups of aquatic insects such as deer flies, horseflies, black flies, and biting midges are vicious biters of man and sometimes are involved in transmission of disease. In addition to the aquatic insects, people who visit water-related and other recreational areas are often exposed to terrestrial arthropods such as ticks, mites, fleas, and flies, and rodents including ground squirrels, rats, mice, and chipmunks.[27, 28] The public health importance of these arthropods and rodents involves a number of human diseases including Rocky Mountain spotted fever, Colorado tick fever, tularemia, relapsing fever, tick paralysis, typhus, plague, bacillary dysentery, and typhoid fever. Irritation, discomfort, and annoyance caused by bites of the arthropods can be serious to the point of reducing the use of an otherwise attractive recreation area. Thus it becomes most important that measures be taken to eliminate or reduce such insect population.

The public health hazards created by arthropods and rodents can be minimized by providing appropriate prevention and control measures during the planning, construction, and operational phases of recreational areas. Detailed entomological, biological, and engineering studies are generally necessary to develop the most suitable prevention and control measures for a particular recreational area. Upon requests, State and Federal health agencies can provide technical assistance of this type. In most instances, naturalistic and source reduction measures provide the most effective control, and over a period of years are more economical than repetitive chemical control measures which should be reserved for situations where adequate control cannot be obtained through prevention and source reduction measures.[29] Hazards to wildlife can be minimized by the appropriate choice of chemical.

PREVENTION AND CONTROL OF ARTHROPODS AND RODENTS

The following measures are recommended for the prevention and control of arthropod and rodent problems at recreational areas:

I. *Prevention and Source Reduction Measures*

A. *Mosquitoes and Other Aquatic Insects*

The following principles and practices are recommended for the control of mosquito problems commonly associated with impoundments. Some of the measures are equally effective against other aquatic insects of public health importance.

1. As a general principle, waterside recreational areas, particularly those which have facilities for overnight occupancy, should be located along sections of the reservoir which have a low mosquito production potential. In situations where it is necessary to locate recreational sites along sections of an impoundment which have a high mosquito production potential, provision should be made for adequate prevention and control measures as indicated in the following sections.

2. Prior to impoundage, the reservoir basin should be prepared as follows:

   (*a*) The normal summer fluctuation zone should be completely cleared, except for isolated trees and sparse vegetation along abrupt shorelines which will be exposed to wave action or in other situations where no significant mosquito production is likely to occur.

   (*b*) Borrow areas resulting from construction of the dam should be located where they will be permanently inundated, if possible. Borrow areas located in the normal summer fluctuation zone or outside the reservoir basin should be self-draining.

   (*c*) All depressions which will be flooded by the reservoir at maximum pool level should be connected with the reservoir by drains to insure complete drainage or fluctuation of water within the depressions.

   (*d*) Provision should be made for utilizing water-level management to minimize conditions favorable for mosquito production to the maximum degree permitted by the primary functions of the reservoir.

   (*e*) Depressions and borrow areas should have relatively steep banks to prevent the development of shallow ponds which minimize wave action and allow the growth of emergent vegetation.

3. After impoundage, the following maintenance measures should be carried out in all potential breeding areas located within mosquito flight range of recreational areas.

(*a*) Vegetation of a type and density favorable for mosquito production in flat, protected areas within the normal summer fluctuation zone should be periodically controlled by mechanical, chemical, or biological measures.

(*b*) Seepage areas that develop below dams or behind dikes should be adequately drained.

(*c*) Vegetation, debris, and floatage should be removed periodically from all mosquito control drains to insure free flows.

B. *Terrestrial Arthopods*

1. Provision should be made for proper storage, collection, and disposal of garbage and refuse in order to prevent and control flies, wasps, and other noxious insects.

2. Provisions should be made for the removal of brush along paths, trails, and roadways and for the removal of weeds from other areas of frequent use by visitors in order to reduce the likelihood of tick infestations.

C. *Rodents*

1. Provision should be made for proper storage, collection, and disposal of garbage and rubbish to prevent and control rats, wild rodents, and other small mammals.

2. All buildings, including new and existing structures, should be rodentproofed to reduce the possibility of rats and rodents creating public health hazards.

3. Provisions should be made for periodic removal of debris, rubbish, and other material which may serve as a harborage for rats and other small mammals.

II. *Chemical Control Measures*[29]

In situations where adequate arthropod and rodent control cannot be obtained through the prevention and source reduction measures outlined above, provision should be made for supplementary use of insecticides and rodenticides to achieve the desired level of control at recreational areas.

When using insecticides and rodenticides, it should be recognized that they are not only effective and lethal for insects and rodents, but can also produce harmful effects in animals or human beings if ingested. It is extremely important that they be stored and handled in a satisfactory manner out of the reach of children and unauthorized persons. Normal control of insects and rodents with the use of these chemical agents can be accomplished by recreation area personnel with proper instruction in large-scale application methods. However, use of highly toxic poisons such as sodium monofluoracetate

(1080) or cyanide should be done by licensed pest control operators. Where difficult or severe problems are encountered, assistance should be requested from a reputable pest control agency. Supplementary information to this chapter can be obtained from the "Public Health Pesticides," annual release prepared by the Communicable Disease Center, Public Health Service.[29]

Mosquitoes

Outdoor space treatments, when properly timed and applied, can temporarily reduce adult mosquito populations to the levels that cause little or no annoyance. The frequency of space treatments in an area will be governed by the rapidity with which it becomes reinfested. Although DDT at 0.4 pound per acre and chlordane or BHC at 0.2 pound per acre based on a 200- to 300-feet-swath width are effective against susceptible mosquito populations, resistance to these compounds in many areas has resulted in the use of organophosphorus compounds for this purpose.

Malathion, the principal organophosphorous pesticide used, is highly toxic to many species of mosquitoes. Fog applications that disperse 0.075 to 0.10 pound of malthion per acre based on a 300-foot-swath width have given highly effective kills of salt marsh mosquitoes.

Flies

The basic tentet of controlling house flies is the *improvement of environmental sanitation*. Continued research to develop new chemicals for fly control has only confirmed that application of insecticides in the absence of adequate sanitational levels is a costly and inefficient tool. Every chemical measure, to fulfill its objective, must be accompanied or preceded by adequate sanitation efforts to reduce or eliminate fly breeding sources.

If it is found necessary to use insecticides for the control of flies, spraying of walls and ceilings with a 5-percent DDT solution may afford protection for a period of time. In areas where flies have developed an immunity to this insecticide and it is no longer effective, use of another agent such as dieldrin, DDVP, or malathion may provide satisfactory results. Care should be exercised to insure that in the application of insecticide sprays food stuffs are properly protected to avoid contamination.

Another fly control agent, as an alternate to DDT, is diazinon. Diazinon cords or string 1/32 inch in diameter, impregnated with insecticide by immersion in 10 and 25 percent diazinonxylene solutions, have been effective against DDT–resistant houseflies. It has also been found that cords impregnated with 25 percent diazinon solution have a higher degree of control than those impregnated with the 10-percent concentration. Diazinon has been effective on the larva of the housefly, and should they be noticed on the organic soaked ground beside garbage cans, 1 pint of a 0.25-percent diazinon solution applied to a small area can be used as a method of control.

Cockroaches

Insecticides commonly used in cockroach control include chlordane, diazimon, dieldrin, and malathion.

The control achieved with many of the organophosphorus compounds appears to be directly related to the completeness of coverage achieved. Staining problems may arise in treating certain types of surfaces such as wallpaper, plaster, etc.

Application of any of these pesticides in households or in food-handling establishments should be as a spot treatment in utilizing a coarse spray or a dust to treat baseboards, along water pipes, and in other cockroach harborage areas and runways.

A suggested method for applying liquid insecticides for roach control is the so-called band or perimeter method. In this approach, an emulsion of the agent is painted from the corner of the room, 4 inches up on the baseboard and 4 inches out on the floor. This band should be continued around the windows and doors so that an unbroken chain of insecticide is formed about the perimeter of the room. This is augmented by use of a hand spray to reach areas behind heavy objects which cannot be readily moved. When insects emerge from their hiding places in search of food, they will often have to cross the insecticide barrier at some point and, in so doing will absorb insecticide.

To obtain a quick kill in heavy cockroach infestations or to drive the insects from protected recesses, the use of aerosol formulations of pyrethrum alone or in combination with a residual treatment is of value.

Ticks and Chiggers

Area control of ticks can be obtained by the application of DDT, chlordane, dieldrin, and toxophene at rates of 1 to 2 pounds of toxicant per acre, or BHC at a rate of 0.5 pound of the gamma isomer per acre. Suspension, emulsion, or dust formulations of these pesticides produce similar results. The level of control secured is dependent on the adequacy of coverage. In brush areas, 50 gallons of spray or 40 pounds of dust per acre are required as compared to approximately half those amounts in sites of thin cover such as lawns, etc. Treatment with these chemicals usually prevent reinfestation for 30 days or more.

Area infestation of chiggers (red bugs) can be controlled with spray or dust treatments of toxaphene or chlordane (1 to 2 pounds per acre), lindane (0.25 or 0.5 pound per acre), or dieldrin (0.6 to 1.0 pound per acre). Application rates of 40 pounds of dust or 50 gallons of spray per acre may be required to insure thorough coverage of the area.

In treating woodland areas for either tick or chigger control, avoid application to ponds, streams, and other watercourses or to their adjacent margins, since at the maximum dosages these pesticides (except lindane) are highly toxic to fish.

Rodent Control

For rodent control, it may be necessary to choose between trapping, the use of rodenticides, or a combination of both. Trapping has an advantage in that when the animal is caught, it may be removed from the premise and does not cause an odor problem, which may often occur if a poisoned animal falls back into a harborage point in walls, floors, or ceiling. However, trapping is also the least efficient rodent control measure because it reaches only a small percentage of the total rodent population.

The anticoagulant poisons have dominated the field of rodenticides for the past decade. These slow-acting rodenticides are preferred for use in most situations because of their effectiveness against rodents and low degree of toxic hazard to humans and domestic animals. Anticoagulant poisons include pival, warfarin, diphacinone, fumarin, and PMP; warfarin being used most extensively.

The effect of the anticoagulants is cumulative so that their rodenticidal action depends upon at least a small amount of poison being consumed almost every day for several days. To achieve effective control, the anticoagulant baits must be continuously available for at least 2 weeks. Establishment of permanent bait stations in places subject to reinfestation provides good continuous control.

Wasps, Yellow Jackets, Hornets [30]

Wasps can be controlled by applying an insecticidal spray or dust to their nests. Chlordane, dieldrin, and DDT are effective for this purpose and are available as emulsifiable concentrates and wettable powders from which sprays can be prepared or as dusts and oil solutions ready for use. Suitable insecticides are (1) a 5– or 6-percent chlordane dust, a 5– or 10-percent DDT dust, or a 1-percent dieldrin dust; or (2) a 2-percent chlordane oil solution, a 5-percent DDT oil solution, or a 0.5-percent dieldrin oil solution; or (3) an emulsion or suspended spray. An emulsion spray can be prepared by mixing a chlordane, DDT, or dieldrin emulsifiable concentrate with water; a suspension spray, by mixing DDT or a chlordane wettable powder with water.

Dusts can be applied to some hornet and yellow jacket nests, whether above or under the ground by inserting the extension tube on a garden-type duster into the nest opening. Two or three strong puffs of dust will filter through the nest and usually kill the colony within 24 hours. A shovelful of moist earth thrown over the entrance of a colony in the ground after treatment will prevent the dying wasps from gaining the surface. An underground nest can also be treated by pouring several ounces of carbon tetrachloride into the opening and then plugging it with absorbent cotton.

Control work should be done at night when the wasps are less active and most of them are in their nests. The openings should be concentrated on when applying insecticides to the nests.

Nests can also be dislodged and disposed of in a sack or other suitable container. Before dislodging a nest, the opening should be plugged with absorbent cotton that has been soaked in carbon tetrachloride. After the nest is dislodged, it can be burned, buried, or put into a can containing a few tablespoonfuls of carbon tetrachloride and the can sealed tightly.

Chapter XVI

Recreation Safety

Recreation areas, to be fully enjoyed, should be free of unnecessary accident potentials. According to the National Health Survey estimates for 1960, there were 5,232 accidental drownings and 1,478 water transport deaths. Estimates on accidents occurring in places of recreation indicate that over one-third result from falls and 9 percent result from being struck by moving objects. Other statistics are equally alarming. Sustained accident prevention requires careful planning and continued vigilance. Factors which must be considered in evaluating a recreation area environment for accident prevention include the selection of the site, proper construction and maintenance of the buildings and playgrounds, and safe practices followed in the buildings and on the grounds. Many implications to accident prevention are mentioned throughout this Guide, but because of their importance, they may be reemphasized in this chapter.

SITE SELECTION

Site selection should consider safe automobile access and egress. Roads should be looped or so laid out so that the speed of vehicles is limited. One-way traffic, if feasible, should be utilized. Sites for travel trailers, tents, and other buildings should be set back from roads and separated to permit safe visibility, and there should be easy accessibility to these facilities by firefighting equipment.

BUILDING AND EQUIPMENT

Buildings in recreation areas should be well proportioned, substantially constructed, and fire resistant. Walls and foundations should be in good repair, free from cracks or other evidence of failure under stress. Floors should be firm and flat; and general plumbing, electrical equipment, and other furnishings should be of standard materials and adequately installed.

FIRE AND SAFE EGRESS

Fire and explosion, with its resultant superheated air, suffocating smoke, and toxic byproducts, is the major single threat to life associated with the structure and exterior premises of housing. Any structure used for living purposes should be reasonably fire resistant. Exit routes should be so located as to provide safe and unobstructed egress in at least two directions from all habital areas. Exits should be marked in larger units such as hotels and resort lodges. Emergency egress procedures should be conspicuously posted. Where groups are being housed for extended periods, emergency exit drills are advisable. Proper fire extinguishers, as recommended by the National Fire Protection Association, should be readily available.

ELECTRICAL WIRING

Inadequate electrical wiring coupled with excessive demands being placed on it by electrical appliances can constitute fire and electrical shock hazards. All wiring installed in recreational areas should comply with specifications of the National Electrical Code or requirements which are substantially equivalent in State or local codes. Basically, the code specifies that sufficient service be available to accommodate the electrical needs of the building; that the wiring be of sufficient size and quality to cope with demands to be placed on it; that equipment and facilities within the system meet these same requirements; that there be an adequate number of permanent, convenience outlets in each room to safely accommodate all anticipated use; and that the service, wiring, equipment, facilities, convenience outlets, and appliances be used in a safe manner. Electrical circuits should be protected by fuse or circuit breaker of proper size. Oversized fuses should never be used. Maintenance crews should be continually alert for such hazards as outmoded or defective wiring, overloaded circuits, unnecessary extention cords, ungrounded electric motors, and other electrical appliances.

HEATING SYSTEMS

Heating units should be so installed and maintained as to prevent fire, burn, and asphyxiation accidents. These units should be approved by the Underwriters Laboratory and the American Gas Association. All of its parts should have adequate clearance from combustible construction, should be of correct size, and have the capacity to operate efficiently without overheating so as not to be dangerous. There should be sufficient air supply in the room to insure proper combustion. Because of the severity and prevalence of fires associated with the use of various types of range oil and kerosene space heaters and cook stoves so often used in recreation areas, they should be given special surveillance.

Floor furnaces set immediately below the floor level and covered with a floor-level metal grating present accident hazards to which children, elderly persons, and the weak are particularly vulnerable. Its two major hazards involve burns sustained when contact is made with the metal grating which may reach a temperature of 300° F. and fire resulting from combustible materials being placed on them. Fire and explosion are not the only potential hazards associated with space heaters. Innumerable case studies of carbon monoxide poisonings have implicated them as being the causative agent. Wherever such units are improperly installed, maintained, or used, the possibility of carbon monoxide poisoning exists.

STRUCTURAL HAZARDS

Some structural considerations aimed at reducing falls and related injury include: alertness to structural weakness brought about by rust, rot, deterioration, or alterations; alertness to badly worn, nonsecure, broken, or slippery floors and floor coverings which may constitute tripping hazards; stair handrails both inside and outside the building; to note the advantages of guard rails around outside porches, balconies, raised terraces, or patios; alertness to protection against overhead unstable objects which may fall; and understanding the inherent hazards presented by single steps, thresholds, and threshold strips. All floor coverings should be of a nonslip type, and waxes should have nonslip characteristics. Toilet rooms and showers should have nonslip-finish ceramic tile on floors.

Sanitation, maintenance, and safety cannot be separated. Recreational area housing facilities are either improving or deteriorating constantly, but they never continue at a status quo. Constant maintenance of a structure along with consideration of its neatness and cleanliness is essential to continued safety of the basic construction and exterior premise.

CAMPGROUNDS

Campgrounds should be as level as possible. Hilly or sloping grounds requiring retaining walls or terraces multiply the hazards to visitors. Grounds should be cleared of accumulations of trash, open pits, and anything else that might cause injury. Weeds should be regularly cut to prevent course stubble from developing and reduce insect, snake, and small animal hazards. All poisonous plants should be cleared from the area. Grading to drain off surface water is essential. Stoves and barbecue grills for open fires should be capable of keeping the fire contained and under control, and sufficiently isolated from picnic tables.

PLAYGROUNDS

Areas in which children may play should be free of severe stone outcroppings, away from busy highways, railroad tracks, and dangerous manufacturing areas. Openings such as abandoned wells, dropoffs, sewage areas, lakes, and ponds should be properly isolated, preferably by fencing.

Where playground equipment is provided, it should be located away from natural pathways of traffic. Steps leading up to slides should have handrails. There should be guards on seesaws to prevent boards from hitting the ground. Playground equipment should be carefully selected and properly placed. It should have supports of galvanized or painted metal, which should be firmly anchored in concrete. Swings offer special hazards which can be minimized by using seats of lightweight material such as belting, rubber, or heavy canvas.

FOOD SERVICE

A basic aid to safety in any food service operation is *Convenience and Efficiency*. The nature of many recreational area places particular stress on this operation. Proper design, supported by preventive maintenance and regular inspection programs, will serve to eliminate many unsafe conditions and maintain a safe and sanitary environment. Major hazards are associated with handling of glass, crockery, hot liquids, sharp instruments, power machinery, exposure to hot cooking surfaces, and portable, petroleum-fired stoves. Cuts, burns, muscular strains, and fractures can be reduced by developing safe procedures, proper maintenance, storage, preparation, and serving. Slippery surfaces and falls due to spilled liquids and foods can be reduced by skid-resistant floors free of broken and missing tiles, defective boards, damaged cement, and maintenance of a clean floor at all times. Walkways should be kept clean, clear, and dry.

There should be routine inspection for faculty or damaged equipment, utensils, work surfaces, walls, floors and ceilings, and faulty equipment should be removed if necessary.

All equipment, particularly knives and other sharp-cutting instruments, supplies, and toxic substances such as insecticides, petroleum products, and detergents should be safely stored away from food and out of children's reach.

SWIMMING POOLS

Accident prevention in swimming pools encompasses considerations of design, maintenance, operation, lifesaving equipment, and qualified lifeguards. Design features such as structural stability, location of diving boards, congestion, water depth, pool bottom slope, filtration and chlorination, plant design, maintenance, and location, nonslip deck construction, facilities for chlorine and chlorinating equipment, and recessed ladders are a few such considerations. Safe lighting and auxiliary pool electrical facilities both within and away from water must meet the code requirements. Dressing room and bathhouse floors should be of nonslip, easily cleanable material. Additional dressing room considerations should include soap dispensers of a type which will prevent spillage, elimination of exposed hot water pipes on which a bather may be burned, and benches and similar facilities in good repair and free of slivers. Pool regulations governing users should be enforced to protect against accidents.

NATURAL BATHING AREAS

The hazards associated with natural bathing areas include dropoffs, potholes, unsafe underwater rock outcroppings, heavy weed growth, cloudy water which reduces visibility and dangerous escarpments near the water's edge. Such hazards should be removed where possible or clearly marked. Depth marking with clearly visible signs is also desirable.

Auxiliary facilities such as walkways, diving rafts, and platforms, recreational equipment, bathhouses, lockers, and showers should be safely constructed and maintained as is the case for artificial pools. A sufficient number of qualified lifeguards should be on duty during all swimming hours.

REFUSE DISPOSAL

Discards such as broken bottles, tin cans, broken furniture, objects with protruding nails, chemical wastes, and containers of toxic and flammable substances are a few potentially hazardous materials which may be encountered at campgrounds, picnic areas, travel trailer parking areas, cabin developments, and other recreational facilities. In addition to the sanitation, insect and rodent control, and disease potentials these discards represent, their accident causation capabilities are very real. Cuts, punctures, fractures, poisonings, and dermatitis, and suffocation have been a few of their other resultant effects.

The hazards such discards represent begin with improper sanitation procedures practiced within the recreational area and their refuse storage sites. The problem is magnified wherever areas are permitted to be strewn with litter, broken glass, fuels, and similar hazardous materials. It is particularly acute where such conditions prevail in bathing areas, pathways, campsites, and children's play areas.

Safe, sanitary, and efficient disposal of refuse, whether it be garbage, trash, or hazardous materials, begins at the point where it is generated. Recreational area regulations for safe disposal procedures should be brief, conspicuously posted, and enforced. Such regulations should specify proper procedure for disposal of hazardous drugs, insecticides, fuels, and similar materials. Safe disposal of such materials may necessitate a special place within the recreational area where final disposal will be conducted by the area's management. Material such as broken glass, cans, and objects with protruding nails should be placed in closable, metal containers. Paper, rags, woods, and similar combustible discards require similar disposal procedures because of the fire hazard they represent.

Chapter XVII

Campgrounds and Picnic Areas[31]

Camping and picnicking have become major recreation pastimes of millions of people that make up today's traveling and vacationing public. Picnicking is usually associated with other outdoor pursuits such as fishing, swimming, boating, sightseeing, horseback riding, hiking, and simply walking for pleasure. Many like to go for an overnight camping trip where a meal can be cooked over an open fire and sleeping bags can be enjoyed by the glow of the camp fire. Camping is often a necessary part of any outdoor recreation outing that extends beyond 1 day. Many campers stay in motels and hotels; however, tents, travel trailers, and pickup campers are looming larger and larger in the camping scene in recent years. Camping in the 1960's is increasing faster than the sites and facilities for camping have been provided. Increases in camping will most certainly accompany increases in travel, for camping makes it possible for families to enjoy weekends and vacations economically far from home. Camping facilitates other outdoor activities, such as fishing and hunting. When resources are developed for such purposes, adequate facilities for camping also should be provided. A survey of participation in outdoor recreation conducted in 1959 and 1960 showed that about one-third of the campers enjoy camping in remote areas removed from other people, while about the same proportion enjoy camping in an area where they can visit with other campers.[32] Consequently both types of camping areas are needed, with proper consideration given for environmental health factors relating to this mode of recreation. Campgrounds and picnic areas should be located in such a manner as to protect the areas that are needed for watershed, timber, range, and other basic resources insofar as physically possible.

SITE SELECTION

The site selected should not encroach on any outstanding natural, scenic, esthetic, scientific, or historical values. A well-drained, gently sloping area is preferred. Sites should be free of rock outcrops and heavy undergrowth. Should a lakeshore area be considered, it should be on solid beach, free of boggy areas and caving banks. Attractive natural ground cover and any trees should be retained as much as possible. Water supply and sewage disposal needs will also govern selection of sites in most instances.

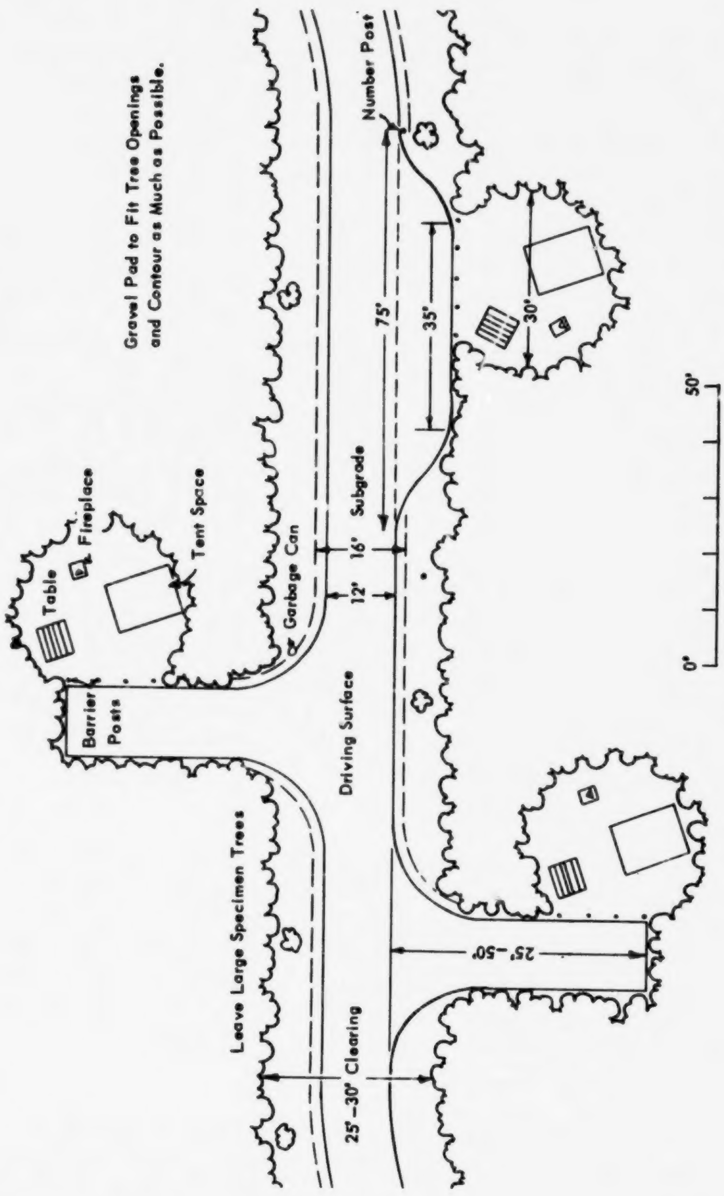

Gravel Pad to Fit Tree Openings and Contour as Much as Possible.
Number Post
Table
Fireplace
Tent Space
Garbage Can
12'
16'
Subgrade
75'
35'
30'
Barrier Posts
Driving Surface
Leave Large Specimen Trees
25'–30' Clearing
25'–50'
0'
50'

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Figure 40.—Campsite layout.

LAYOUT

The first principle of layout is to confine vehicles to designated parking areas and fires to specific locations. For good management, sites should be composed of a number of integrated though independent sections. Circulation roads for each section should preferably be one-way, all-weather roads, and treated to reduce dust. Campground roads should be laid out to provide access to individual campsites, while picnic grounds should be laid out on a walk-in basis with multicar parking areas.

The number of sites per section will be influenced by topographical conditions, but should also be reconciled with the most economical distribution of central comfort stations. All elements should be fitted into the landscape.

If preservation of park values within a campground site requires the spacing of parking areas and campsites at a considerable distance apart, an alternate campground site should be sought because the cost of constructing roads and utility lines becomes excessive as the space between campsites increases. Generally a range of about 4 to 7 campsites can be obtained per acre, while the range for picnic areas is about 10 to 15 sites per acre. Each picnic site should contain one table and bench combination and one fireplace, preferably a charcoal burner for each two to four tables. Each campsite should contain a car parking space, a tent, or vacation trailer area, one table and bench combination, and one fireplace. However, each area should be given individual attention to obtain the maximum number of sites per acre consistent with preservation of park values and consideration of the visitors' experience. Examples of typical layouts of campsites and picnic areas are shown in figures 40 and 41.

SIZE

Where visitor use warrants, campground and picnic areas should have a minimum size of about 90 to 120 sites for efficient operation. It is recognized that further economies in operation and maintenance will be made as additional sections are added to the initial area and operated by the same staff. The repeated development of small campground and picnic areas of 10, 20, or 30 sites should be avoided in the interest of economical service to larger numbers of visitors.

WATER SUPPLY

Campgrounds and picnic areas should be provided with an adequate supply of safe drinking water. Water hydrant stations with non-threaded, self-closing faucets, properly drained to prevent standing water, should be provided within 150 feet from any of the campsites

An example of a good picnic site layout with consideration for appropriate amounts of shade, pleasant surroundings, reasonable but not excessive separation of tables, and relationship of picnicking to parking areas, comfort facilities, water, and shelters.

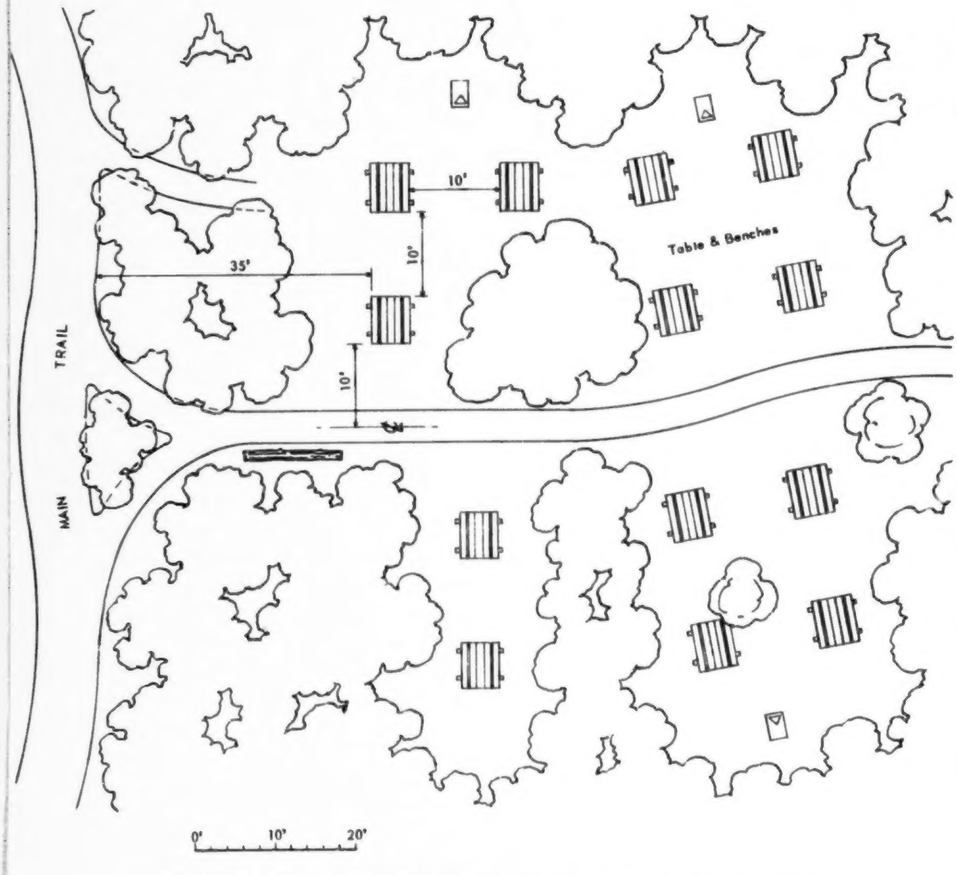

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Figure 41.—Picnic site layout.

and individual picnic table areas. In addition, a number of risers should be provided with threaded hose bibs located strategically throughout the area for fire protection. Fire hoses should be provided and stored in centrally located hose boxes. Both hose storage cabinets and fire hydrants should be properly identified.

In smaller areas, especially those in remote locations where power is unavailable, an approved well with a hand pump or spring may be found adequate. In areas where a water supply system is not possible, it may be necessary to provide a source of water from pickup stations. Campgrounds without adequate water supply should be discouraged, or in any case should be limited to emergency use or not more than 20 campsites. Campers should be warned of the danger in using a stream, lake, or brook for drinking water without proper treatment, as described in chapter IV.

REFUSE DISPOSAL

Durable, waterproof and rodentproof containers should be provided near the circulation road and a maximum of 150 feet from any camping and picnic site but not near a water hydrant. These units should be sufficiently stationary to minimize being overturned by domestic and wild animals. The construction of a heavy wrought iron base into which the container can fit reasonably tight will provide a sturdy stand. They should also have flytight covers and be maintained in a clean and odor-free condition at all times. The swinging lid-dome type cover is useful in this regard.

COMFORT STATIONS

Adequate toilet facilities should be provided to serve all campgounds and picnic areas. In areas where water under pressure is available, modern comfort stations, as described in chapter VI, should be located within an approximate radius of 300 feet for campgrounds and 500 feet for picnic areas.

Pit privies as described in chapter V should only be provided after all efforts have failed to obtain modern flush toilets that depend on an adequate water supply and an approved means of sewage disposal. The use of privy units in detached or remote areas will, of course, be the only practical solution in many instances, but careful, frequent maintenances is always required to avoid objectionable odors and nuisances.

Chapter XVIII

Stable Sanitation

Horseback riding is an outdoor activity available in many recreation areas. Horses are also used to pack supplies to remote back country or wilderness areas and are essential for fire control, border patrol, and searching parties in some areas.

The primary environmental health concern associated with the use of horses is the stabling of these animals and related manure disposal. Accumulations of such wastes afford breeding places for flies, and unless controlled, will invariably produce large numbers of flies, and also public health officials recognize that flies constitute a public health hazard and that the abatement of fly populations is essential to the control of certain communicable diseases.

STABLES AND CORRALS

Horses should be stabled in a location removed from but readily accessible to the main recreation area center of activity to minimize potential odor and nuisance problems.

Stables should be located on a well-drained, gently sloping site, and of durable construction to protect the building from destruction by fire and from deterioration or damage by breakage, rodents, termites, and dampness. Floors in horse stalls should be paved with wooden blocks sealed in asphalt or of other impervious material except concrete and sloped to facilitate proper drainage. Floors in the feed and tack rooms should preferably be of concrete construction so they can be hosed down and maintained in a clean, odor-free condition. A sufficient number of hose bib water outlets should be provided throughout the stable for this purpose.

The stable should be provided with an adequate drainage system so that all liquid wastes can be satisfactorily drained away from the stable. Difficulties with stoppage of drains can be reduced if drain lines are installed without bends so they can be readily rodded and solid matter removed when necessary.

The stable area should be provided with adequate, conveniently located toilet facilities for employees and visitors, consisting of at least one watercloset, one urinal, and one lavatory for each sex. A shower should be provided if the stable is used for sleeping purposes by the caretaker.

Corrals and paddock areas should be gently sloping to facilitate natural drainage to minimize standing pools of surface water. It may

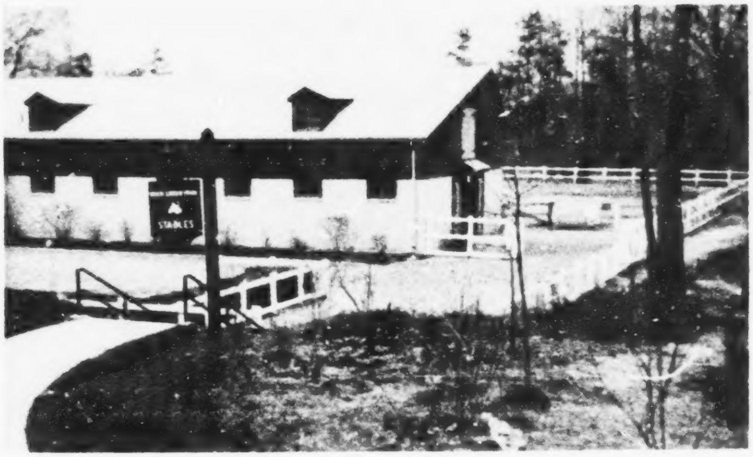

Figure 42.—Well-drained stable site.

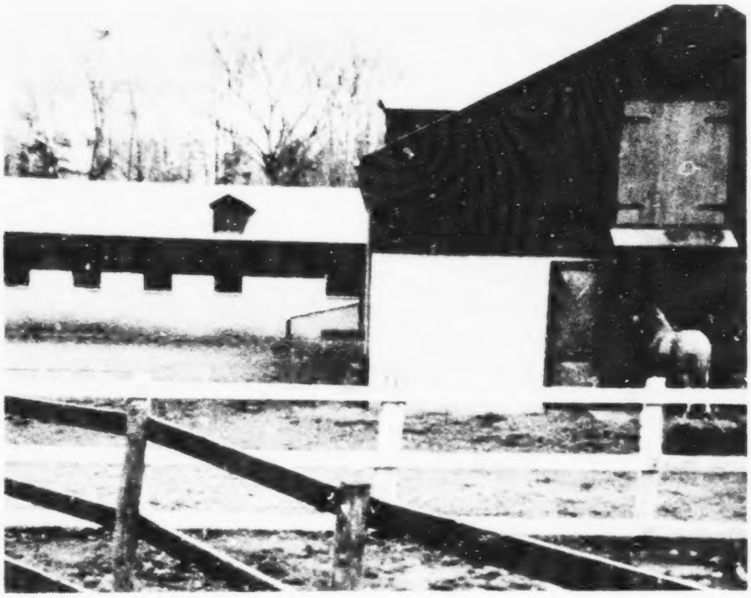

Figure 43.—Clean, well-maintained corral and barn area.

be necessary to construct a base course of bank run gravel (40–60 percent sand) approximately 4 to 6 inches deep covered with approximately 4 inches of wash sand to obtain adequate draining. A drinking water trough should be provided in the corral area for watering the animals. Water supply and sewage disposal facilities should be provided in accordance with the guidelines contained in chapters IV and V of this Guide.

INSECT AND RODENT CONTROL

The stable should be of rodentproof construction. Openings to the outer air should be effectively screened when necessary against the entrance of flies and other insects insofar as possible. Grain feeds should be stored in metal-lined bins with covers to provide insect and rodent-tight facilities.

The application of insecticides on the interior walls, ceilings, and stall area and the exterior of the stable building will assist in controlling excessive fly population. Chemical control measures should be conducted in accordance with chapter XV of this Guide.

MANURE DISPOSAL

All manure should be removed, and stored or disposed of in such a manner to prevent the breeding of flies therein. The quantity of manure and bedding for stabled horses will average 2 to 3 cubic feet per animal per day, the weight depending on the character of the bedding and the amount of moisture.[33]

Manure should be removed from the stalls and corrals at least once each day, preferably in the early morning. Final disposal during the fly-breeding season may be accomplished by either—

1. Spreading the manure upon the ground in a thin layer not over 1 or 2 inches thick. The drying area required varies from 4 to 12 square feet per animal depending on the thoroughness of the collection and amount of bedding. It generally requires 4 to 7 days for the manure to properly dry. Fresh horse manure should not be spread on pastures used for grazing by the horses; or

2. Providing a physical barrier to keep the flies from having access to the manure by—

(*a*.) Storing the manure in a pile that is completely covered with a plastic mesh tarp or approximately 1 inch of dry material such as loose dirt, dried manure, and sawdust.

(*b*) Storing the manure temporarily in a tight screened manure shed having a floor of impervious material such as concrete or asphalt and then spreading periodically on the ground in fields as in (1) above or hauled away for use as fertilizer by farmers.

The effectiveness of the manure disposal procedure used should be determined routinely by checking the manure to see if fly larvae are present.

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Appendix A

American Standard Specifications for Drinking Fountains

1. The fountain should be constructed of impervious material, such as vitreous china, porcelain, enameled cast iron, other metals, or stoneware.

2. The jet of the fountain should issue from a nozzle of nonoxidizing, impervious material set at an angle from the vertical such as to prevent the return of water in the jet to the orifice or orifices from whence the jet issues. The nozzle and every other opening in the water pipe or conductor leading to the nozzle should be above the edge of the bowl, so that such nozzle or opening will not be flooded in case a drain from the bowl of the fountain becomes clogged.

3. The end of the nozzle should be protected by nonoxidizing guards to prevent the mouth and nose of persons using the fountain from coming into contact with the nozzle. Guards should be so designed that the possibility of transmission of infection by touching the guards is reduced to a minimum.

4. The inclined jet of water issuing from the nozzle should not touch the guard, thereby cause spattering.

5. The bowl of the fountain should be so designed and proportioned as to be free from corners which would be difficult to clean or which would collect dirt.

6. The bowl should be so proportioned as to prevent unnecessary splashing at a point where the jet falls into the bowl.

7. The drain from the fountain should not have a direct physical connection with a waste pipe, unless the drain is trapped.

8. The water supply pipe should be provided with an adjustable valve fitted with a loose key or an automatic valve permitting the regulation of the rate of flow of water to the fountain so that the valve manipulated by the user of the fountain will merely turn the water on or off.

9. The height of the fountain at the drinking level should be such as to be most convenient to persons utilizing the fountain. The provision of several steplike elevations to the floor at fountains will permit children of various ages to utilize the fountain.

10. The waste opening and pipe should be of sufficient size to carry off the water promptly. The opening should be provided with a strainer.

Appendix B

Basic Principles of National Plumbing Code, ASA A40.8--1955

Principle No. 1—ALL OCCUPIED PREMISES SHALL HAVE POTABLE WATER

All premises intended for human habitation, occupancy, or use shall be provided with a supply of potable water. Such a water supply shall not be connected with unsafe water sources, nor shall it be subject to the hazards of backflow or backsiphonage.

Principle No. 2—ADEQUATE WATER REQUIRED

Plumbing fixtures, devices, and appurtenances shall be supplied with water in sufficient volume and at pressures adequate to enable them to function properly and without undue noise under normal conditions of use.

Principle No. 3—HOT WATER REQUIRED

Hot water shall be supplied to all plumbing fixtures which normally need or require hot water for their proper use and function.

Principle No. 4—WATER CONSERVATION

Plumbing shall be designed and adjusted to use the minimum quantity of water consistent with proper performance and cleaning.

Principle No. 5—DANGERS OF EXPLOSION OR OVERHEATING

Devices for heating and storing water shall be so designed and installed as to guard against dangers from explosion or overheating.

Principle No. 6—USE PUBLIC SEWER WHERE AVAILABLE

Every building with installed plumbing fixtures and intended for human habitation, occupancy, or use, and located on premises where a public sewer is on or passes said premises within a reasonable distance, shall be connected to the sewer.

Principle No. 7—REQUIRED PLUMBING FIXTURES

Each family dwelling unit shall have at least one watercloset, one lavatory, one kitchen-type sink, and one bathtub or shower to meet the basic requirements of sanitation and personal hygiene.

All other structures for habitation shall be equipped with sufficient sanitary facilities. Plumbing fixtures shall be made of durable, smooth, nonabsorbent, and corrosion-resistant material and shall be free from concealed fouling surfaces.

Principle No. 8—DRAINAGE SYSTEM OF ADEQUATE SIZE

The drainage system shall be designed, constructed, and maintained to guard against fouling, deposit of solids, and clogging, and with adequate cleanouts so arranged that the pipes may be readily cleaned.

Principle No. 9—Durable Materials and Good Workmanship

The piping of the plumbing system shall be of durable material, free from defective workmanship, and so designed and constructed as to give satisfactory service for its reasonable expected life.

Principle No. 10—Liquid Sealed Traps Required

Each fixture directly connected to the draining system shall be equipped with a liquid-seal trap.

Principle No. 11—Trap Seals Shall Be Protected

The drainage system shall be designed to provide an adequate circulation of air in all pipes with no danger of siphonage, aspiration, or forcing of trap seals under conditions of ordinary use.

Principle No. 12—Exhaust Foul Air to Outside

Each vent terminal shall extend to the outer air and be so installed as to minimize the possibilities of clogging and the return of foul air to the building.

Principle No. 13—Test the Plumbing System

The plumbing system shall be subjected to such tests as will effectively disclose all leaks and defects in the work or the material.

Principle No. 14—Excluded Certain Substances From the Plumbing System

No substance which will clog or accentuate clogging of pipes, produce explosive mixtures, destroy the pipes or their joints, or interfere unduly with the sewage-disposal process shall be allowed to enter the building drainage system.

Principle No. 15—Prevent Contamination

Proper protection shall be provided to prevent contamination of food, water sterile goods, and similar materials by backflow of sewage. When necessary, the fixture, device, or appliance shall be connected indirectly with the building drainage system.

Principle No. 16—Light and Ventilation

No watercloset or similar fixture shall be located in a room or compartment which is not properly lighted and ventilated.

Principle No. 17—Individual Sewage Disposal Systems

If waterclosets or other plumbing fixtures are installed in buildings where there is no sewer within a reasonable distance, suitable provision shall be made for disposing of the sewage by some accepted method of sewage treatment and disposal.

Principle No. 18—Prevent Sewer Flooding

Where a plumbing drainage system is subject to backflow of sewage from the public sewer, suitable provision shall be made to prevent its overflow in the building.

Principle No. 19—Proper Maintenance

Plumbing systems shall be maintained in a safe and serviceable condition from the standpoint of both mechanics and health.

Principle No. 20—FIXTURES SHALL BE ACCESSIBLE

All plumbing fixtures shall be so installed with regard to spacing as to be accessible for their intended use and cleansing.

Principle No. 21—STRUCTURAL SAFETY

Plumbing shall be installed with due regard to preservation of the strength of structural members and prevention of damage to walls and other surfaces through fixture usage.

Principle No. 22—PROTECT GROUND AND SURFACE WATER

Sewage or other waste shall not be discharged into surface or sub-surface water unless it has first been subjected to some acceptable form of treatment.

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